

Options glass, up togen from amounts, results for phopsing and greatery.

## The End of a Foreign Monopoly

Optical glass assumed, over night, a new and terrible importance, when the world went to war with Germany. For the world, so far as it knew, was largely dependent on Germany for the higher grades, dependent on an enemy for the very eyes of fleets and armies—periscopes, aeroplane camera-lenses, search-lights, field glasses, range-finders. And optical glass cannot be made over night.

But it so happened that a favorite dream of our founders was of emancipation from foreign control of raw material; and for some years we had been quietly experimenting. When war came, we were ready—and ready not merely with methods and formulæ, but with a modern and complete glass plant—the first in America for making optical glass on a compercial scale,

Events have shown its immeasurable value in wartime. And it will prove no less a factor in the arts of peace.

For with our own optical glass to work with, developing various types as required, we can carry forward faster and more surely those refinements of lens and instrument making which to science mean knowledge, and to humanity a richer, safer life.

Write for literature on any optical product in which you are interested

BAUSCH & LOMB OPTICAL COMPANY . . . ROCHESTER, N. Y.

Makers of Epopless and Spectacle Leases, Photographic Leases, Microscopes, Boloptimus,
Binoculars and Engineering and other Optical Instruments.





# The trademark of supreme musical quality It means the world's largest and greatest musical industry

Twenty years ago the talking-machine was a triviality. Today the Victrola is an instrument of Art. The exclusive Victor processes have lifted the making and the playing of musical records into the realm of the fine arts and rendered them delightful to the most keenly sensitive ear. Opens singers and musicians of world-wide fame are glad to be enrolled as Victor artists.

Every important improvement that has transformed this "plaything" into an exquisite and eloquent instrument of the musical arts originated with the Victor. The Victor plant, the largest and oldest of its type in the world, is the world-center of great music-

No other organization in the world is so quali-

fied by experience, by resources, and by artistic equipment to produce supreme quality as the Victor Company. Its products convey more great music by great artists to more people throughout the world than all other makes combined.

The pioneer in its field, the Victor Talking Machine Company today remains the pre-eminent leader. The famous trademark "His Master's Voice," with the little dog, is on every Victorla (look inside the lid) and on the label of every Victor Record. It is your guarantee of the highest musical quality. Look for it. Insist upon finding it. If you wish the best, buy nothing which does not contain this trademark.

New Victor Records on sale at all dealers on the 1st of each month

## VICTROLA

Victor Talking Machine Co., Camden, N. J.

"THE WOOD THAT ALL ITS USERS PRIZE, THE WISE INVESTOR SAFELY BUYS."

## A WORD

as to the

## Reasons and Purposes

behind the

## Cypress Pocket Library

Everybody likes to build, but nobody likes " repair jobs."

Repair jobs inevitably represent an additional investment without any addition to value.

That point is worth digesting,

When you build, whatever you build, you like to build "for keeps."

Some people change their minds about styles, in building the same as in wearables; our tastes develop and result in changes in our wants; but nobody changes his or her mind as to wishing to get the greatest possible endurance, or wear, out of the things they buy, and especially is this true of building investments.

Yet, singularly enough, so many people know so little about woods and their relative values and special utilities; so many people think that "lumber is lumber" and never attempt to specify the KIND of wood they wish used; so many people believe that repair bills are "necessary evils," that we believe we shall be able to render a real public service by continuing the publication of THE CYPRESS POCKET LIBRARY, convenient in size, authoritative in character, of probable value as a technical guide, and careful and scrupulous in its every statement or inference.

We have not, and do not, by any means, recommend the use of Cypress without discrimination; Cypress is not the best wood for corry use; but where it IS appropriate it is so emphatically (and demonstrably) the one best wood that the many should know about it instead of the comparatively few who formerly profited by their special knowledge.

WRITE FOR VOLUME I, with full text of U. S. Government Report on Cypress, and containing complete list of all the 43 volumes in the library. Then write us for the volumes that will best serve you.

It may be of interest that many of the volumes of The Cypress Pocket Library have become established as standard works of reference—text-books—in a number of eminent educational institutions and Governmental Departments. This is a gratifying tribute to the broad and helpful spirit in which these booklets have been produced, and more than justifies the theories behind the original pioneer idea of such a Library for Lumber USERS.

Let our "ALL-ROUND HELPS DEPARTMENT" help YOU. Our entire resources are at your service with Reliable Counsel

#### SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION

121) Hiberoic Bank Rudding, New Orleans, Louisiana, or 1816 Heard National Bank Building, Jackson-Re. Florida

INSIST ON TRADE-MARKED CYPRESS AT YOUR LOCAL LUMBER DEALER'S IF HE HASN'T IT, LET US KNOW IMMEDIATELY

## Popular Science Monthly

FEB., 1920 Volume 96-No. 2

### **Better Subscribe Now**

VERYTHING that goes into the making of a magazine has more than doubled in price in the past two or three years. It is to help meet this situation that the POPULAR SCIENCE MONTHLY with this issue becomes twenty-five cents a copy. And on February first the subscription price will become \$3 a year. Until then the subscription price will remain \$2 a year, or \$4 for two years. Canadian postage 50 cents. Foreign postage \$1.

### CONTENTS

Two All-Metal Arristanes Feather-Wright Air Mail Caught as He Jumped A Life-Boat for the Sea-Coring Dirigilds Can Word Be Used for Airplane Wongs	33 47 48 48 54 65 76 81
Out of the Air into the Sea A Winged Horse to Real Life Music in the Air Music in the Air Music in the Air Music in the Air Casaling the Airpines	54 65 75 76 81
INDUSTRIAL PROGRESS	
Has the Old Windmill a Rival? The Radiator-Lifter Cutting Steel Bare with Giant Science The Machine with a Dipper that Dignand Dumps	21 22 23

pyright, 1930, by the Modern Publishing Cor

Portical Science Movemer a remod morthly. Yearly subscription in the United States, \$3.00. Capada, \$3.50. Foreign, \$4.50, totale core, 25 cents. Portical Science Movemer way be had at all newsciences in the United States and Capada; also from the International News Company, London, and at Brendama, Park.

(Continued on page 4)

Advertising rates on application. Forms alose the twentieth of the second months preceding date of publication. Entered an second-class matter Dec. 28, 1915, at the Post Office at New York under the act of March 3, 1879. Entered as second-class matter at the Post Office Department, Canada.

The contents of this manualne are contrighted and must not be reprinted without permission. H. J. Fisher President, R. C. Wilson, Vice-President, O. B. Capen, Secretary and Treasurer.

Committed interior

Modern Publishing Company
225 West Thirty-ninth St. New Yor

# A Startling Memory Feat That You Can Do

## How I learned the secret in one evening. It has helped me every day

THEN my old friend Fautkner invited me to a dinner party at his house, I little thought it would be the direct means of getting me a one-hundredand-fifty per cent increase in salary. Yet it was, and here is the way it all came about.

Toward the close of the evening things began to drag a bit, as they often do at parties Finally some one suggested the old idea of having everyone do a "stunt." Some mng. others forced weird sounds out of the piano. recited told stories, and so on.

Then it came to Macdonald's turn. He was a quiet sort of chap, with an oir alrest him that reminded one of the old saying that "still waters run deep." He said he had a simple "stant" which he hoped we would like. He selected me to assist him. First he asked to be blindfolded securely to prove there was no trickery in it. Those present were to call out twesty-five numbers of three figures each, such as 101, 249, and so on. He saked me to write down the numbers as they were called.

This was done. Macdonald then astoynded everyone by repeating the entire list of twenty-five numbers backwards and forwards. Then he asked people to request numbers by positions, such as the eighth number called, the fourth number, and so on. Instantly he repeated back the exact number in the position called. He did this with the entire list-over and over again,

without making a single mistake. Then Macdonald asked that a deck of cards be shuffed and salled out to him in their order. This was done. Still blindfolded, he instantly named the cards in their order backwards and forwards. And then to further amass us, he gave us the number of any card counting from the top, or the card

for any number.

You may well imagine our amazement at Macdonald's remarkable feat. You naturally expect to see a thing of this sort on the stage, even then you look upon it as a trick. But to see it done by an everyday business man, in plain view of everyone, blindfolded and under conditions which make trickery impossible, is astenishing, to say the least

N the way home that night I asked Mardozald how it was done. He said there was re lly nothing to it-simply ory feat, the key to which sayou easily learn in one evening. Then he told me that the reason most people have had memories is because they leave memory development to chance. Anyone could do what he had done, and develop a good memory, he said, by following a few simple rules. And then he told me exactly how to do it. At the time I little thought that evening would prove to be one of the most eventful in my life, but such it proved to be-

What Macdonald told on I took to heart. In one

evening I made te-markable strides toward improving my numbery and it was but a question of days before I bearied to do enmithy what he had done. At first I amused my set with my new-forces abstract. my new-found ability by anazing pen-ple as parties. My managey feet. My my founds caded it, myrely made a bit. Everyone was talk-ing about it, and I mas showered with invitations for all sorte of affairs. If atmospe tents to sale its how managed to annetic white to make me how quickly to derively according to the house our market of the third what I want to tell you.

The point gratisfying thing along the improvement of the toronory was the reporkable way it helped me in sur-ness. Much map authorise discon-seed that my mem-

areal that my memory training had have been properly pure ensure. My brain had become eleater, quicker, become I fait that I was tax as around that meantal group and abstraces I had so often atmosf in men who were spoken of as weathers and generally. The text thing I policed was a marked improvement in my moverestabled powers. Formerly my take was being and the marked I power could think in things to say and the conversation was over. And there were a was too late. I would always think of apt and striking things I might leave next. But next hard striking things I might leave next. But next hard striking things I might leave next. I have no do is to start to say to make the greatest impression on people. inspression on people.

It wash's long before my new found plainty to remember things and to any size right thing as the right time attracted the attention of our personant. He get in the habit of spiling one in whomever be wanted facts about the business. As he expressed himself to use. You can always tell me instant's what I want to know while the other left as army me by distingt our of the other and myring I it book it up.

FOUND that my ability to remember belped me wonderfully in densing with other people, particularly in committee meetings. When a discussion opens up the man who can back up his statements quickly with a string of definite facts and figures usually dominates the others. Time and time again I have won people to my way of thinking simply because I could instantly recall facts and figures. While I'm proud of my triumphe in this respect. I often feel for the ill-ut-case took of the other men who cannot be in up their end in the argument because they can part recall facts instantly. It seems as though I were forget anothing. From the I we put in made is as clear and as easy to recall instantly at though in were written before me in plant black and white.

We all hear a lot along the importance of sound We all hear a lot along the importance of enough potential. Freque who night to know say than a man cannot begin to correcte seath pulgions and he is factly to fifty rears of are. But I have deposed all that. I have found that cound industrial a nothing more than the platter to wearh and judge facts in their relation to each other. Memory is the boson of sound judgment. I am only thirty-two, but many since I have been complimented on having the independs of a man of forty-five. I take no personal cream for than —it is all due to the way I trained my memory. -it is all due to the way I trained my memory



Table are only a few of the hundreds of which I have presented by my trained missions. No tonger do I make the properties mad discussing them I know and that being plate to recept their name. The minimum I me as the name fusion to my notice to read but making of facts insuch him. I always there to read but quantity dargot quark of it. Now I find it case to read but quantity for all the test to easily what I have read another surprising thing is that I may now master a subsect to considerately few thee that I can never in aster to oursiderately few thee that I for event in detail almost pit will. I famely make a noblatic.

My reconstant, too, has horeness woulderfully, Whenever I see a striking word of a preschool, I menoche it goes that the first point use it he my disturbing or representation. This has purely to make it to be a striken word of the property of the preschool of the second business bettern. And the young the property of it all is that I this how do not shad a write quick the part of it all is that I the how do not shad a write quick not prove the miles with the first less effect chapty to some property property of the allowed the part of it will be entire used an item to not presches. But the latest the part of it all is that alone has a versory property than strength has the material of our president my salary has strength hard to make the large Machinakh mat the interested in implementally my become?

That is the Both Menous Course." I this that the Both Menous Course." I this is less I learned to the all the rots principle things I have took you about. The publishers of the Both Menous Course that Many I have took you about. The publishers of the Both Menous Course the Both Menous to they one are transfer memory that they will globby estal the Course to propose approval.

You need not you a single pentry until you have come included the Course and both that II fulls Dave up to all the suppose of verse at least on motion. Marrie pull the coupon of verse a least and the couplete t purpose will be sent to you be not to all the suppose of which that the output the pull the couple for R. Sent on motion. Marrie pull the couple for R. Sent on motion. Marrie pull the couple for R. Sent on motion. Marrie pull the course the post in the fact will not eath when the pull the course being proposed. If after exaction from you had as thousands of athers light them that the Roth Menous Course Course Course of the womand a good bospacity. Now you can be not a Bospanian you pay no money not been been proved that the Course will because by Menous you have account of the the least to the light marries and proved that the Course will because the tenth in filteral offer the minute interesting aritims. Sent many the marries of a substitute the interesting aritims.

to withdrawn.

#### FREE EXAMINATION COUPON Designation of the second seco

#### INDEPENDENT CORPORATION Publishers of The Independent Weekly Dept. B. 772 , 119 West 48th Street, New York

Please widel says	he Rech Men-	ore Course of	f gesten temperat.
I will gither remai	I she Cuspee to	you wishin	DAN GREE PLON,
Us Personnell did bertief	d worm ILS du du	of the service of the	of the temper.

Adpan	 	 	 	

Pop. Bolence. 9-20,



FEB., 1920 Volume 96-No. 2

## A Real Position Like This—for YOU CONTENTS—Continued

The country needs thousands of trained, Certified Electricians to fill good positions - and at big pay. It's all a matter of knowing how, and I will teach you by up-to-date, modern instruction. You can learn at home, without interfering with your regular work, by my highly successful method of Home Instruction in Practical Electricity,

Prepare NOW, and be ready in a few months to earn your

## \$46 to \$100 A WEEK

Send for this Book-

Chief

Eng. Cooks,

442Can St. Disapell.

Problem of the Charles

Name - --

Che correction content content

My book, "HOW TO BECOME AN EXPERT ELECTRICIAN," has started thousands of young men on the way to splendid success. A new edition of this has just been printed. I want every young man interested in Electricity to have a copy, and send you one, ABSOLUTELY FREE AND PREPAID Write me today.

### How I Train My Students

As Chief Engineer of the Chicago Engineering Works I know exactly the kind of training a man needs to enable him to get and hold good positions, and to earn big pay. I have trained hundreds of men who are holding splendid electrical jobs.

I give each of my students personal attention and a complete and thorough training, give him a SPLENDID ELECTRICAL OUTFIT FREE, and much of the training is done by actual work. When my students graduate and receive their certificate they are ready for a real position. But still more, at any time you wish you can come to our splendidly equipped Electrical Shops for special training. No other school can give you this.

## A Real Opportunity for YOU

Wishing is never going to make your dreams come true. You've got to study-to learn. A man is worth only \$2 or \$3 a day from his neck down-and no more; but there is no limit to what he can be worth from his neck up.

A trained mind is what gets the big pay. It is this training that you need, and I can train you in a few months. Are you ambitious to make a real success—then send me the coupon - today.

#### Electrical Outfit Free

To every student who answers this ad I am giving a splendid Electrical Outfit of standard size Electrical Tools, Instruments, Materials, etc., absolutely free. Furthermore, to every Electrical Student I give a truly valuable surprise that I cannot explain here.

#### Free Employment Service

I am continually receiving requests from employers to send them trained Electrical men. I assist my students to secure good positions. I keep in touch with them for years, helping and advising them in every possible way.

#### Write Now-Don't Delay

Delay never got you anything. Action in what counts. Get startedand get started now. Write me, or send me the coupon, right NOW.

L. L. COOKE, Chief Engineer

### CHICAGO ENGINEERING WORKS

DEPT. 32

: : : : CHICAGO 441 Cass Street

ş

Wood and Cardboard Paving	25
I be the property of the design and the party of the part	26
The Thirty Furth Stamp A Postable Power Sew Rejuvenating Tin Cans	29
A Postable Power Saw	29
Rejuvenating I'm Cans	32
1 Period the likewister this will be for a second	12
Ho Sturk to One Idea	
Greater Educates from the Hasting Builer.	
Greater Etherency from the Flucting Boiler	
Acetalene as a Substitute for Consuling	
Destric Husts for Lighters	16
The Hone of Street and Clay	
The Phone of Diraw and Slay	54
An Cleatric Divining Rod A Power Plant on Thesia	- 24
How Hot Is the Furnace? Ask the Pyromes	mr. 55
Bullon Button Of with the Button	27
Carrying With in Tanks Instead of Cana.	70
I a horner Shout that had some in believe home	5 M
Welshing I racks with a Street Blad	56
A longer that Cutting Will Make	50
Harmonian the Manhinese to the Work	4.0
This is a Wagwagging Typewriter	60
This is a Wigwagging Typewriter Making Leaf Springs by Markinery Corresponds Aid in Steel Work Push Your Portable Only Iron Hole to Hole	61
Germanical Aid in Speel Work	21
Push Year Purtable Drill from Hole to Hole	- A2
They Munkeyed with the Buge Sawanana	42
Bus Saved Is Maney Saved	87
Disco Lags for the Wurk-Dench	- B2
One-toch Belt Carries a Thomasid Harmpow Fighting Flaming Oil with Foam	" B
One Machine Does the Work of Five	
Moving Poles without Disturbing Wires	
control of some annual contactual sends	Sec.

#### MOTOR VEHICLES AND ACCESSORIES

An Automobile Ambulapes for Injured Care
This Ship Was Built to Carry Automobiles
Let Your Thumb Help to Identify Your Car
red 1 mit 1 games could be to seeming 1 and Cut.
A Tractor Turns Locemstive
It Keeps Air from Freezing
Use the Labourt to Test the Engine
A Vince Iron the Roadway
One Way of Hiding the Evidence
This Wheel Lays Its Own Track
The Elevator Carage
A Special Pittsh for Pulling Wagons as Trailers
Eliginate Guerework in Lugare Testing
A Partable Crune for the Garageman

#### NATURAL SCIENCE

1s Yellow Light Best 2
b Yellow Light Bent? . 2 When Communicate Co Fishing for Their Masters 20
It Samply Got Their Goal
There Lightning Struck Three Times
low Fast Does a Bird Fly)
What Is Its Speed). If What an Univ Baby
Wood that Competes with Steel
The Ferr on an Irish Putain
Mees the Cataglo, a New American Half-Bread 70
Food and Pivat
When Muther Larth Tipe the Senior B
When Muther Larth Tipe the Senior R

What the Eigh Can Do.
Men's Lives Depend Upon the Shill of Those
Men's Lives Depend Upon the Shill of Those
Who Make the Airplane Propeller 4
Cleaning Un Atter the A La F
When the Human Herd Stampedes
There's Always Something New in Acutatories
los the Motorist
The Belongings of Soldier Sons Who Diad 7
Sode Will Have Its Davi
Do It with Tools and Machinery 7
Housekospong Made Easy
The ALL DECEMBER

#### RAILWAYS

Is It Possible for the Railway Truin to Have Airplane Speed? To Keep Ties from Rotting

Continued on page iff

## How a Failure for Eleven Years Became an \$8000 a Year Salesman

He thought he had reached the limit of his advancement—but by shifting to sales work he more than quadrupled his salery, in less than three years. The following account of Fred MacCluren's asperience is typical of successes being won by thousands in the selling field today.

By JAMES ALLISON



"A slugle idea I consider emponelide for my encouse—that the sig pay goes to the men in the criting side of business."

HEN Fred MacClaren went out on the road as salesman for the B——
Corporation, there wasn't a fellow in the office who had any idea he would make good. That was several years ago, and I was only an office cub then—but I remember well the scepticism as to Mac's success. Mac had been a stockroom foreman for going on cleven years—a likable sort of fellow, but not the kind that one would ever imagine making a big success for himself.

Yet that is exactly what Mac did. He made good in sales work right from the start, and inside of eighteen months was outselling our voteran salesmen. And hardly a year later, when Jonkins, our Sales Manager, was hired away from us by a competitive company. The General Manager pulled blac off the road and planted him is the private office up front as Sales Manager. I don't know what kind of salary proposition they made him for the new position, but while he was still on the road, his salary and commission checks went through my department, and considering the fact that he was making from \$150 to \$180 a week as salesman, I imagine they must have made the Sales Manager's job look pretty attractive to get him to accept it.

#### Mac's Sudden Success was the Sensation of the Office

Of course, everywee around the place thought Mac just plain every-day fucky—but I knew there must be something more than luck re-

"And besides kading better pay in sales week. I found a let of nettingation in karing a job that enabled me to past on the best trains—to stop at the juvest hotels—in most new people duty."

sponsible for such a turn of fortune. I knew Mac well enough to know that he could have stayed in the stock room till he was retired on a pension and never have been raised above \$55 a week. And yet-without showing a particular aptitude for salesmanship, he had gone into the selling field and achieved a striking success. Those days I was pretty much concerned about how I was coming along myself-I had been a bookkeeper with the B- Corporation for three years and was only making \$27.50 a week. So use day I side-tracked Mac as he was passing my desk and told him I had something I wanted to talk over with him and wondered if he would take lunch with me some noon. Muc agreed so a couple of nones later found us together at the Reynolds cafe.

I told Mac fearbly what I was teleking about bore some of the each said by was term lasty been others thought be had discovered some somes some and routest or to tell him of my som troubles and my death in profit by his experience. Mac sharked at the idea that his said rest was being attributed to the discovery of a success server.

"There really isn't any secret about it " was Mor's sleeple assertion, "I you're interested I don't mind triling you the whole story.

"I amply not to the point where I exultin't are anything but a blank wall abread of me as a structures foreman. I sended to make more mores, and of 1-10 a week was all I was swith after closure years, I figured it was up to the loger into a better paying fine of week. It was at this point that I morabled note the king than I consider responsible for my upones. The big pay gives to the men in the swing ride of business.

## Why Highest Salaries are Paid Salesmen

"I looked around me at the successful men I knew, and it came upon me like a flash that practically every use of your was identified with more force of selling. And it is only natural that this should be so.

"There is a good reason why the same ability will command a larger income in the selling end of hunteress than in the other departments. The men in the shop making the goods—and the men in the office handling restine accounts and credits—can never be no vital to a business as the men out selling whose afforts actually determine how much goods shall be made. The payred figures of any large concern will bear out the truth of this cituation.

"But the third which really decided as on recountry a salesman was an advancement in a case of firms. I beginned to ski up. This new of firms. I beginned to ski up this proby the National Sciences. Training Association and a service which and to be exactly what I was look at fee. The N.S. T. A.—as a note of malestical forms—is an observation of top-order hadestical forms—is an observation of top-order hadestical forms—is an observation of top-order hadestical forms—is for the movement of top-order the association in its Free Employment Burst and that helps its members find the bind of for fire which they are best fitted. I found the course of training of Sin N.S.T.A. to be not wrat I needed. There as nothing mysterman about it—it traches you have to prepare the Science Trife how to approach the present—how to manage the intercept—how so close the sale. In fact, it makes all of the processes of salesmanship so simple that It is hard to imagine how atomic could fail to become a good calesman by following the principles they nothing.

#### How Mac Became a Star Salesman

But the most peached feature of their mores is the fact that it hoke about to occupantially and far you for sers above one how. To what up a long easy in a few words, I attained with linkers, who is not bake Manager at that time, to transfer me to the sales force—and found must be able to reduce the selling job right from the start—thanks to what I had ingreed from the N.S.T.A. course, And breaker feeding better pay in sales work, I found a lot of satisfiantian in higher a job that reschied me to travel on the limit frequence may at the form lines to rear first passing daily. If you really are serious about watering to better possess, they advant to that you investigate aglicromes who, and postuniarly what N.S.T.A. training van do for rea. The hope early the same apportunity to surveye other, bestkersper, printer, meritains or farm buy about the same of the ground operation of the same into an well as I have. The N.S.T.A. trains you from the ground operation, partition, without making it are softing the ground op given your spars time, without making it are softing too begin selfing—and then they agh its Employment Bureau you mention a good passition until you are ready to begin selfing—and then they agh its Employment Bureau you mention a good passition.

Mac's sienty was an exercisency for me. That very hight I wrong the National Salasseem's Training Association for facts on the training he had told not need. I found show system for this year for the sales full even room valuable than Mac bud perceed it. Above a couple of southering the had perceed it. Above a couple of southering the prejudent into I accurred a selling position through their Employment Repeats with a local on wholesaler. Of course, I haven't made the success Mac has yet, but my pay thenks already are nearly several times what I was making as bookkeeper—and with N.S.F.A. typining to back me up. I know I'm going to reach the \$10,000 a year class before long.

## "Opportunities in Selling" — A Book You Should Read.

My advice to everty man acrissely interested in getting about in to write the Association to mail you without court their basis describes the present space taxonics infered by the sales to N - explaining why the demand for sales man always a condection of early why the scarcity of sales man is partie of you for any large - telling just how its Course to partie of you for any line of eather just how its Course to sales and you for any lines of other national court the lasts are letters from handrole of other national sees of the Association, describing sections of other nations, described services with openings for salesman.

Mail congam below or nost card today—It may change your whole life. Address National Salesmen's Training Association, Dept. 18-11. Chicago, Ill., V. S. A.

#### National Salesmen's Training Ass'n. Dept. 15-8, Chicago, Rt., U. S. A.

With no obligation on my part, plones send me full information stone the N. S. T. A. Training and Employment Service. Also a list charting there of business with servings for attenues.

Name	 *
Street	 
City.	 State





**Drawing Outfit** 

or other executive positions.



Estra Charge)

Every student of the Chies-go Tests Home Study Course

in Dustingsmilly produce tals draw T nymers, triangles. drawing board, scale, curve, drawing paper, sensile, etc., or a cash credit in case he already has an onesis. These instruments are of the same make and sizes as used by high salaried experts to drafting rooms of factories, skops, salironds, etc. You tree them while hearning—then take them right into your practical work.

NOTE: Enrolled with Chicago Tech tion of practical work the personal divertion of practical engineers building and architects who teach you the menhads they ign in their own work. No underso theories, to take western Volt are prepared to stand tempo old, experienced near tile advantants to bear troth a start (the this propry signs a specialist.

#### Come to the College or TRAIN at HOME

Wherever you are you can have this Chicago "Tech" training. Complete instruction by mail. Exercises besons, personal direction of our experts right in your own home if you cannot come to the college for a resident course frend the Coupon and get the facts.

## Easy Payments

Let the Chicago" Tech" engineers train you At least get the free lesson and information.,

The fees for Chicago "Tech" courses are very moderate -anyou can pay on easy terms. And also you can obtain in a few spenths what it would take several years to acquire by ordinary methods. You can got an early start. You are soon ready to take n paying position and to quickly got back the cost of your course.

Other institutions ask the par first and the to had one later how well quarted you are for this profession. We send the free leases first and place you under no bligging at all. Discovery wer qualifications before you gay anything. And see for yourself has what Change rounelf just what Chingo
"Tech" offers you in training which will brine a
county market for your
services and open opone. toxides which any closed to the assessmed man, The coupon will bring oll the fasts about the and the easy terms.



Mark with X the branch you are in-terested in or if in doubt about which course to take, write a letter staring facts about yourself and seking our selvice, which will be levely given. Mail other the component the letter today.

#### CHICAGO TECHNICAL COLLEGE, 231 Chicago "Tuch" Building, Chicago

Without adding tion upon me, send poor Canadag on enhance or finated below. Also FibEE Laurence if impales to on Deafting

or Plan Reading					
Mark X opposity work	In w	Minb (100	BATTE.	a marin gr	Interested

- Architectural Orahing
  - Marking Strafting
- Straggard Draft or Sheen Metal Drafting Builden Course

The Realing - Buch	
	lings
Plan-Happing - sthop	3dir

- Acresantics
- Autor and Gas Engineer

pt		 				-	-	-	-	4,6			+				 		 •••	••
44	-		 ó					 			rt								 	••
City.		 	 					.,		.,	 	m	i.	-		٠.		٠.	 	ú

College of House Study! State with ......

## All about the principes of the Automobile All about the principes of the Automobile All about Carbon as and Fuel English Systems. All about Carbon as and Fuel English Systems. All about Tarbon as and Cooling. All about Magnets Express. All about Manuals Excessor. All about Stating and Lighten Protein. AERONAUTICS

Auto and Gas Engine Course

All about sub-mable mechanism to construction, operation and REFAIR—tamph by mail. You train directly order the Caleago Tree automobile experts. Special apportunities open here.

Learn All This in Spare Time

Complete Conne in Arrennatio Engineering. Druce purple smale shoot. Equips you live expect work.

Write from the common and get mentage and of

### CONTENTS—Continued

SPORTS AND PASTIMES Fold Up Your Boot and Walk. Put on Your Skares at Homeo Another Motor Bicycle
Something New in Motorcycles

aw Arrives in Japan ..... A Core-Boy Test
The Speeds Mester Soudder
Through the Breakers on a Suri-Boat That Can't A Monster Movie Screen ... Play Solos and Accompany Yourself

MISCELLANY First Aig Taught to a Pulman Iso She the Lougest Han I. Beating the High Cost of Living in East Africa Restring the Fager Court

A Balcour Scene

Smooting the Family Court

The Arch of Many Woods

A Country Your Shore

A Country Your Shore

A Country Your Shore

A Country for told Fact

Always Pain on the Window-Pane

Due t Dray the Store-Lid

A Battonaccod Lady A Restance of Lady

A Betweenered Lady

Within the Law

Taking a Last Look at the Stills

How to Keep Cuper

Whe Lawredowing Kills Cluthes

A Sup-Shape During-Room

Now Here as Real American Tears

Bindholded Magnists

A Coal-Many Street for Hand

A Coal-Many Street for Street

The Rationary The Street

The Matamorphisms of a Fair of Surpenders

He is Called The Cho the Health Clown

Cho a Street of Your Fireham

An Oak Tire for a Derrock Many

A Publishing Lanne bing

Scapped as They Created to Earth

Resping His Kir Ly in Data

Fooden Deer of the North

In Inch Lamn that Name No Bernery

The Law Wild Not Let Him Share

Into the Wilds with Decides and Pennils

The Pare and Lamning Step

Civing a Battleship a Name Soil

Brance Takes a Lamning Battle

Harresing the Alligator

He Pennils Lines on the Mare

One Way to Keep Straight

A Mois a Daily Battle

The Shares Name and Brook to Cradie

Sharing Sone and Brook to Coal
The Brook Sone and Brook to Coal
The Brook Sone and Brook to Coal
The Brook Son

#### RADIOTELEGRAPHY AND TELEPHONY

Tractical Operation of Theorements Detectors and Wave lengths by Chart control Yang Planeses with a Special Rhenatal supporting Bank Yang Arrivals Were Really Large loss the Ground Switch and Avail Lightning lavy Vacuum Lube Collection

#### PRACTICAL WORKERS

Marking Lode for Purposes of Identification
An Increased Col. Tank Arrangement
Lines West Retter in Winder than in Sumber
Repairing Your Stocking Apparatus
The Hairpin Competes with the Corter Key
Lietter Fan Dries Photographic Plans
To Lien Speciales Quickly and Efficiently
Elizanation the Unraweling of Friction Tape
To Make a Handy Cas Soldering Torch
Surface Counter Lathe Attachment
Int Borris Holder that Won't Upsel
Wagon Feller Makes Round Fence Corpers
How to Straighten a Bent Automobile Frame A Figurity Electric Light for the Work-Belich

Keep Your Traceses from Wrinking

How to Make a Part of Clembing Sours

Relief Bearings in the Weight Arm of Lovernor

148

Rose to Make a Simple Spack Plug Tester

148

Kees Through a Conduit on the Automobile

A Handy Book Stand for the Sick Room

149

A Tan-Foot Camers to Make Portraits of Innects

120



## I Got a \$10 Raise Today

Thousands of men have done what this man did. Hun-

I'ST think, Jane, it's only as weeks since I got those books from Chicago and here Johnson called me into his office today and mid: "Ben, you'll find an extra ten spot in

your envelops tonight I recommended it to the office a week ago and I see it's gone through. It's coming to you, old man, and I'm mighty glad to see you get it. There's been a marked change in you and your work lately. In fact, you seem to be a different man entirely. Using your head now, I've figured. That's the stuff. Keep it up and there'll be another ten before Always remember that the bost is glad to pay the man who uses his head."

Do you remember the night you told me I ought to send the little coupon that brought the books? We were mighty discouraged then. My salary hadn't been incremed for several years and with everything costing more and more each day it seemed like we never would get out of the hole. We can do it now, though, Jane, This extra money every week will buy all those things you and the kiddes need. Besides, we'll have a little left over to put

I can't belp recalling, though, what Juhrsen said about using your hend. Here I am, almost therefore, Always considered a good workman. I dain't think there was anything about my work that anyone could tell me. Those books not only proved how little I knew, but in vix works they brought me an increase in salary. With all my years of engenicase I couldn't get that exten money 'till I get hold of the books. It actuately does pay to use your head. I'm going to keep right on with those books 'till I knew procything that's in them. Another thing, I'm going to tell avery young follow in the shop what they did for me. Just think where we would be boday, Jane, if I had potten those books ten years ago.

#### Hit-or-Miss Experience Won't Do

There are a lot of fellows like Ben to this world Somehow or monther shough they don't get one and. Homehow or monther shough they don't get one and there's something lacking in them and it's only one thing—training. Testating discoult measuredly mean going up school. It thesen't mean burdeline or specifies. Not in these days. Any man with an ordering school education—any man who can read himself at home. It won't interfers with his work either. It takes space time only.

#### How Do You Stand?

The sire and prowth of your pay-envelope during the past few years and ted you whether or not you are one of these men who need training. If your exculog capacity has not kept ours with your wants and needs you do need training. Make up your mind right now to get it. Join in with the thougands of men all over these United States who are training themselves at lumns — Train for the higger

dreds are doing it every day. You can do it too. Your ambition is the only limit to the heights you can climb. job you must and leave never been able to get.—Train for the bigger solary that present day conditions demand you get, but which you are not fitted to earn. Don't let another that passe before you begin to train your head as well as your hands.

Let This Society Help You

The American Technical Society, a majety formed for the parameters of engineering and business orlupation has published a number of house study courses excepting different trades and professions in back form. They will give a main just the training he needs to make good on any job. These books are the product of the best engineers and expert authorities that make be presented. I very opport has wrinten so the subjects he known most about in plain, model language. One an average school offentiers is measure to understand them. Each book is study attail with hyadrada of pictures, that book is study attail with hyadrada of pictures diagrams, discriming as simple as All C. These books are continuous too. The American Technical Society a society formed

#### All You Need to Realize Your Ambitions

Here is a list of these great home study brooks. They are proposed on the very best book paper of animable, in large, every toward type with bundreds of pictures and bound in granice American Maturest. All brooks are thousand in gold. The original publication price was set by the sensors as \$1.00 a volume, but large it was decaded to self the books in complete sets only at a very big out from the original price, and on easy re-orbits payments. Are set will be sent for a week's free cammanages. No money is accessed. promising.

Automobile Engineering, 6 relunes, 2000 pages, 220 Bustrations. Propages for Garage Ferman, Automobile Mechanic of Charfford. Invaluable to Car Owners. Regular price \$8.000. Now \$21.80

Civil Engineering. 9 volumes, 3000 pages, 3000 dilac-transistes. Process for Civil or Structure Linguister, Transistena, Lemanter, Designer or Clark Double-man. Regular press \$4.50. Now \$29,80

Corporary and Contracting. 5 volumes 2138 pages, 14 pages, 10 Propose Cuttoner, Busher, Superior select or Carrenter Foregas. Depter pages 32 and Now \$19.86 price \$21.00.

Electrical Engineering. 5 columns, 2800 pages, 2000 phonos. Prepares for District Lugiment, Power Phon Superintendent, Substitute Operator or Line trician. Regular power \$40.00. Machine Shop Practice. For Junes, 2110 yages, 2700 15 at the Powers for Machine Source, Papertensulent or Forenace, Foundry and Pattern Source,
Tool Designer or Tool Makes, Regular price 23110.
Now \$19.30

Practical Accounting. 4 volumes, 1840 pages, 800 illustrations. Prepares for Accountant, Expert Root-hesper, Cost Clerk or C. P. A. Examinations. Regular Princ \$20,000.

Street and Gos Engineering, 7 volume, 2300 pages, 2300 illustrations. Propages for Stationary, Marine or Lammotive Engineer or Fireman. Regular price \$25.03. Now \$21.96

Tolophony and Tolography. 4 volumes, 1728 pages, 200 illustrations.
Prepare for Telephone Engineer, Wire Chief, Enchange Manager, Trouble Man or Telegrapher. Regular prior that of the Prepare for Panisary Locincor, Heating and Ventilating Engineer, Manuel Plansber or Philipher, Regular Price 2000.

[Regular Price 2000.]

Low and Practice. (With reading course in 25 bound promphisms of volumes (90) pages, well illustrated.
Persuses for all Bar I commuters. A wonderful
and to Business uses. (Bound in genuine Law Buckrate.) Regular price \$72.00. Now \$44.50

Mechanical and Architectural Drawing, 4 volumes, 1478 pages, 1070 illustrations. Proputes for Mechan-ical or Architectural Drahaman, Designer, etc. Reg-ular price \$33.00.

Pire Prevention and Insurance. 4 volumes. 1500 pages, 0.0 Shutrations. Prepares for counterman, Base Clerk, Inspector or Fire Jusquace Agent, Segular proce \$20.00. New \$15.80

A consulting membership in the society that unually solis for \$12.00 will be given free with each set of these books. You can consult the society's expering any time by mail on any subject connected with your

Send no Money Just fill out the coupet, below, writing in the name of the backs you want to look at. The whole art will be sent you without delay by express collect. They will be sent you as you ploase for one untire week. This will pive you sufficient time to find not resetly what the books will do for you. At the end of our week, you enter send the books hash at the engeness of the senery or send only \$2.80 as first payment. You send the balance of the cut prim the same way—\$1.00 each month (for law \$3.00). Remember that if you are not under any obliquation whatever, Sending for them whatever, Sending for them, it simply gives you an opportunity to look their over. Out the coupon out

This coupen is the approved form adopted by the except. It is not an order-tank, but a request for free exacomation. You will not be asked to suppose the suppose of the exact to suppose the suppose of the exact to suppose the exact to suppo

grighten sies Bestralishkungasakklunghungungang American Technical Society Dept. X-202, Chicago

Please send me a set of for seven days. Free constraintion, shipping charges reflect. I will examine the books thoroughly and if smiled with three was much 42.50 within seven days not \$2.00 (Law \$1.00) each mouth until I have paid the special price of \$1.11 decide not to keep the backs I will notify pound the end of a week to arrange for their return at your expense. If I purchase the backs I am entailed to a one year membership in

the tends I on entailed to a one year membership in

Name		
Address-		
City——	State	

Place fell to tell hora.

#### **Book Bargains**

#### Finish This Stor For Yourself-

The girl gut \$6 a week and was burely. Piggs you can baugine his kind. was waiting downstairs. He knew where champoons and music could be bed.
Itual that night size didn't
go. That was I are
Kuchener's doing.
But another night?

#### O. Henry (12 Yolumes)

tells about It to the story, with that full knowledge of women with that fronk faring of sex and that clean mind that has endeared hier to the quest gip! women of the land.



Navar was there an other the tipe. Not only decrease as the tipe process post for one unique of the first edition, but you got for the first edition, but you got first back London's Weste' 3 hard-seep yoursess without paying a case. You get if your produces without paying a case. You get if your produces without paying a case.

#### SHIPPED ON APPROVAL

We will ship the two remplets opts on that you state look thath court or you? have each then double afterface or not yes with to bus. If you are not delighted with O. Hence ited the free Jack London south; in and we will take the same bank as shoutfully as we sent place. How could not proposition be tooks take?

#### INSPECTION COUPON

THE REPERSONS PURSUING STATE 148 Carpette Risgs, through Mt.

Please ship was an approval the Warder of Ct. Happy, 12 visiones, half teather building, good tops. Also the 2 visiones set of Jack London bound in alle shield. If I have the bester I will pay you \$1.00 m for proposed within 10 than after been use promote and \$1.00 per parameter in the proposed set with pay in the proposed set of the per parameter in the proposed set of the per parameter is paid, and it is agreed I am to receive the fact London set within the sharp and receive a set of the parameter of within the state of the period of the pe

ů.			
m	•	_	4

Stations or Employer ....

### Ridpath's HISTORY of the WORLD AT A BARGAIN



We will reaton out Burgei's Print and every forest of payment and that free out 22 beautiful samely report to all reprint that trained in the supers for your constitution to printed at the buttern of the supersceners. There off the compensation many and soldiers planely and mad give behavior togeth it. These sets are trained see, becausing bound in seen Fabritand building. This is your last appartments to but before the price year up.

#### FREE COUPON

WESTERN PEWNISHER ASSOCIATION 160 Sc. Departure M., Chicago, D.

49-00

Term mail your through five sample bookled of Sidposh's Huma's of the World, containing photographes of Napolitic Sciences. Cleans and other great cluration in history, and exits up talk particulate of your special offs to Popular Science Mantalg readers.

ADDRESS....

### 90to 250 a Month SIGNAL FreeBook TellsHow

Trained men are in hig demand at good salaries be the Signal Derearranged of every large rangement

Today the opportunities are bigger and better that their

#### MEN ARE NEEDED

are approache sended at exhibits because from \$20 to \$250 a the spacing message in our started in this far-DESIRE ICEL

Write tasks for Free Book dopt all the facts information for a local metal and the facts for the facts of the

DEPARTMENT OF SIGNALING 1810 Wilson Ave., Room 1302, Chicago

DEPARTMENT OF SIGNALING

1810 Wilson Ass., Rossa 1202, Chicago Plants well as should be free and proposed, a Chief entry along on its acc may be seen beauty on liquid superselected. At the little species on this prostages much seek poor many according to the species on this prostages much seek your many or Prop Chatter.

## Finger Print Detectives Wanted



EN are wanted by the government, police departments, corporations, banks, institutions and individuals them men must be trained Finger Print Men men who have made this work a profession

## Big Salaries

and big rewards go to these experts because they solve mysteries that haffle the most experienced ordinary detectives. The finger print clew is one that cannot fail because no two people in the whole world make the same mark.

#### Succeed Can Iou

in mastering this fascinating, big moneymaking profession by studying to your spare time at home. Common actool education is all you need. A brilliant career is before you. Finger Print experts travel everywhere, see the country, live The best house and have all supernon pand. There is a crying need for such men right new. This prefusion is not crowded. Get started at once right new and he one of the hig mean in the field. Get our free book today.

## Mail the Coupon Right NOW!

Fill in this coupen and mail it right new. This may be the big opportunity of your life, so due to waste another migute. When you send the coupon we will send you sur

### Free Finger Print Book

Talls you all about finger prints—the hig appror-tunities in this profession, and everything you want to know about it. Send the coupon new.

University of Applied Science

1772 Wilson Ave., Chicago

Please send me Pree Book on Finger Prints and full information about your course of study.

J.SD (W.

Age ..... Domouries.

## Copy this Sketch

and let me see what you can do with it. Many newspaper artists carning \$36.00 to \$125.00 or more per week were trained by my course of per-s al indicional hosons by mail. PICTURE CHARTS make original drawing easy to learn. Send sketch of Unco Sam win 6c in stamps for a majo Picture Chart, but of the result statements.

of macrossful students, ex-amples of their work and evidence of what YOU can accomplish. Please state your age.

### The Landon School

of CARTOONING and ILLUSTRATING
1211 Schooled Bldg. Cleveland, Ohio

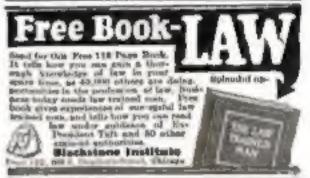
Great apportunities for Pates I men as Mether Externs, their Francisch Lightney Chauffeiles, or in business for regreed.

CAN EARN \$100 to \$400 Per Month

You mare here by posture on overalls and doing the argued to the timber expert testimated by the method you cannot belt. If you have received by a future where you can make the movement here it is.

WHEN TUDAY for enjoymention.

BUFFALO AUTO SCHOOL Dopt. 118, Buffalo, N. Y.



If you stammer attend on stammering school till you get my big new FRES book and special rate. Largest and south successful school in the scale suring til forms of delective quests by presented natural contloct. of delective queeds by advanted.

North-Western School for Stammerers, Inc. Milwaukee, Wit. 2335 Grand Avenue



#### DO YOU LIKE TO DRAW?

Cartounists are well paid

We will not give you may grand prive if you assure this ad. Her will be ships by inche you say that if you are to describe the a week. Not if you are to describe your manners with a manner conful entwentied, no you wanted a copy of this privities, with a manner of the privities.

The W. L. EYANS SCHOOL OF CARTDONNIE \$25 Laube Bidg. Clerified, 944

## ANGUAGES CHIENES

hits harring a tree and as may " first disc LANGUAGE PHONE METHOD
and Research of Proculed Linguistry
The war has treated enfinited epositionity. Propersons to latter your position, or instructs your
leading. Bright in so the leavener you stolled
it school. Bright of Backlet and Free Treat Uffer THE LANGUAGE PHONE METHOD
SEE Pubmen Bidg. 2 W. 4549 81. K. Y.

## Apring The Angelous services RAILWAY MAIL CLERKS

Essentiantions aton. \$1300 to \$2125 a year. Steady the time job. Common education sufforest No. "pull"

forest No. "p

Patterna Civil Service School, 18-C Saws Sidg., Reshouser, S. Y.

Fire: Send me without charge your booker describing this and aslan

Patterne (2vd Entster Holms, 16-C Kross Bidg Backenies, for C. S. Covernment positions.

Congress manage

de la



## "Here's an Extra \$50, Grace —I'm making real money now!"

"Yes, I've been keeping it a secret until pay day came. I've been promoted with an increase of \$50 a month. And the first extra money is yours. Just a little reward for urging me to study at home. The boss says my spare time training has made me a valuable man to the firm and there's more money coming soon. We're starting up easy street, Grace, thanks to you and the I. C. S. I"

Today more than ever before, money is what counts. The cost of living is mounting month by month. You can't get along on what you have been making. Somehow you've simply got to increase your earnings.

Fortunately for you hundreds of thousands of other men have proved there is an unfashing way to do it. Train yourself for bigger work, learn to do some one thing well and employers will be glad to pay you real money for

your special knowledge.

You can get the training that will prepare you for the position you want in the work you like best, whatever it may be. You can get it without sacrificing a single day or a dollar from your present occupation. You can get it at home, in spare time, through the International Correspondence Schools.

It is the buttern of the i C S, to prepare men in just your cocumstances for better positions at better pay. They have been doing it for 28 years. They have helped two million other men and women. They are training over 100,000 now. Every day many students write to tell of advancements and increased salaries already won.

You have the same chance they had. What are you going to do with it? Can you afford to let a single priceless hour pass without at teast finding out what the I.C.S. can do for you? Here is all we ask—without cost, without obligating yourself in any way, simply mark and multiple coupon.

INTERNATIONAL CORRES	PONDENCE SCHOOLS
80X 7863, 5C	RANTON, PA.
Contain, without abiliraries are by	w run number for the seal
Couldny without addigating the by	I mark X.
Constitute of boursess.	I DEAL FAMANISHIP
C freetric Lighting and Rollmann	CAUVERTISING
Electric Winks	Window I rimmer
Telegraph Laginer	Show Card Writter
DER MADIFAL REGISTER	Rullroad Trainmon
Mechanical Destantas	LUSTRATING
Machine Shop Precion	Cortocolog
C per ten sikura	THE PERSON NAMED IN TAXABLE PARTY OF TAX
Can Enguer Operating	Privata Servetacy
Oritic districts	TOTO WEELS HE
N BE Pokkeles on Familiagus	— 5 постравно выд Туріц — 5 го Рамію Ассентамі
STATISTICS BUSINESS	TRAFFIC MANAGEM
Marine Lugraphy	Rallway Acrowmand
Ship Thraftallion	- I promocrini 1 am
TARCHITECT	⊇OΩD ENGLISH
Continent and Builder	Leocher
Concrete Beliefe	Common School Beldent
STREETHEN LABORET	CAVAL SERVICE  Mulleng Mail Clerk
PARTICIPATION AND RESTRICT	CACTORONICE OPERATION
Sheet Mest Windor	Dinte Bepatring
Taxable Overtides for Supply	Navigation 10 Smaleh
CHEMIST	LORS THE PROPERTY IN
التاريخ المستحدة	Petter Baldes 17 Indian
M	
Petter.	
Present	

Commence on a year of this compare for

City.

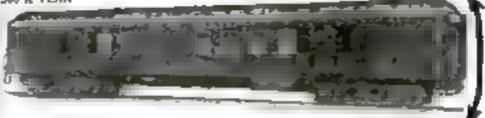
WANTED RAILWAY MAIL CLERKS 1800 MEN, IS TO 35, TO RECOME

COMMENCE \$1300 A TEAR

Apple advancement to littler Government Designer PRINCE YOURS og v

number residents and city residents of the same of the Paul vacarban

Write connectately for free left of Lavernmen peel one pair to the lavernment peel one pair upon the transport of peer it upon the peer it upo



PRANCHED INSTITUTE, Bept. Mills, ROCHISTER, N. T. This estate of 10 ct. at we done only up the dominant to the second parameter a free contract to the first three to the form of Green managed pure more ones ones of the more described parameters are to be second to the first three characters and the first three characters are the president to the first three characters are thre COLPON

Balino; Mott Flerk. Postoffice i leek Postoffice Carrier Ents, Mail Carrier Bookhovjer

\$ 1,00-\$1.00 \$1,00-\$1.00 \$1,00-\$1.00 \$1,00-\$1.00 · 0 ( 7 PH-4) Land

Castama Positions Internal Berraus Stenographer (1130-3130) Gleck to the Dopartments of Washington (5130-5130)

Milhe

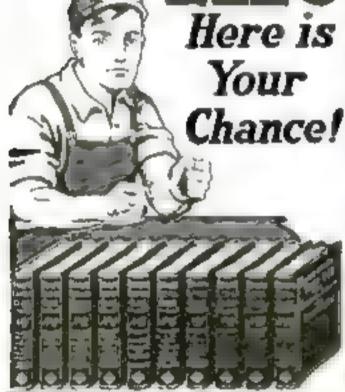
Address Paradas before payone in 18 cm payons,

Same

\$5000 IN SCHOLARSHIPS-ENTRIES CLOSE FEB. 1, 1920

If you want to compare he can of Papuller Science Mainthly a \$500 Set observance and in Your Bedge on of below helpmany — 4830 — I mit conducted over published as the Jacober Lande.

Scholarship Committee—Popular Science Monthly, 225 West 39th Street, New York



Here is You need specialized knowledge today if you are to higsler earthcal forces and command the high salary of an electrical expert Succost in electricity will come through your about to any are and use the exertanced knowledge of othersknownings contected and condensed in Hawkins Exectrical Condes

> Just think how much these books will help you. In Hawkins Electrical Guides you always have at hand for immediate reference or study a wonderful work containing 4 "on a stratums and 3 too pages which cover all subjects principles, theories, practices, problems, troubies, and ways of doing things electricates

The Guiden fit your probet. You tun carry a quarter attent or it is a still you have mastered the residents. All outsets are indeeded on high your man find the other of it invests by the nestern of our and answer 4th, it has been as a fall at element of pulled yourself and our effects to the probe problem to the problem of an area of an area of the latest policy of a current problem.

HAWKINS ELECTRICAL GUIDES

The year want to be the facts about the fall owing electrical make parts. Then are at expects to the whole force can tree. It is contributed in the case of the lateralists in the contribution of the whole force can tree. It is the contribution of the lateralists are quity or a present in the parts of the collection o done effect the continuence of and every color was a figure of the color of the col

والاهدادية

Arte **TOUR** friends

About

Hawkins

Guides.

EXAMINATION COUPON

3539 Pages-4799 Pictures Flexible Covers Pocket Size \$1 A Month \$1 A Number

Shipped to You FREE

Rend to receive Proposition (for health first size and for a size of a size of a had J arm THEO AL DEL & CO. 12 FH7B 4FL New York, N.Y. term. Please eabtril the Ratkaha Ricetrical Onldes price to each the Openshies I say far my I moved to send may

11 or in move a days and to

ther many a 4 arb mouth to stop of the present of the presen

Signature

Occupation.

Employed by

. P.H.M. 2-20

**Auto and Tractor Mechanic** Eura \$500 to \$400 a Manth Young man, are you werdenkedly believed?
Come to the Bureary actual, Learn to be un expert. I take us to be un expert. I take to be un expert. I take to the ware regreef, that othe source of the SWEEDLY STSTEM of practical training by which 5.000 soldiers made trained for L. R. Coverage and Deep 20.000 expert mechanics. Learn in a few washes, do previous superiods becausely FREE Write today for therepated from public showing bursters a f per area o a maching in new Militon Dollar Trude Sebrot. LEARN A TRADE

Making Trials of Type Type by Think-A-Plemy Capitalize YOUR Ability

This protection from officer communicational to be for making money of a unique state our This processing now offer an intersection of the forest agreement in a few and the arress appeared to the first a plane to agree the first and the first and

A LES BRYANT SCHOOL OF PIANO TUNING

BECOME A



is Cause and Cire 3

MANUEL N. BOOLE Indianapolis, Indiana

Be of the first carried and the state of the

present to the Praint will believe being the through problems, flow Borts, S. C.







## A Maker of Millions -and Millionaires

ON'T mass this rare offer the greatest opportunity that ever has come to you. Take no chances. Do not risk delay This unparalleled offer may not appear again. Fill out the company and may at NOW. We was send you at once absorption free for examination the mass remarkable book of recent years—the most sensational sociess in the whole history of horis-In this small space we among her not explain what the areazing back will do for you how it will be your feet ofto the along and some road to some anorabet. In the timed at the wit are just a few of the thousands of words of praise written to us by persons who have read the look

No matter who you are it where you are -no relater if you have made some progress or none at all toward. financial independence—you need this book. And while this offer lasts it costs you have my penny to see than read it and to learn for yourself its procless secrets. \* Power of Will is not ake any other book you ever saw it read bentitely new and advient the first practical thorough systematic course in will training ever produced

Other men get neh and they to not kell themselves in the struggle cither. You can make money you can win success just on easily as they when you know how when you have read the sample secret of their method

## Extraordinary Offer

#### Personal Experiences

Acres 200,000 seem of "Presure of Will. Append 201,000 appears of "Pressure of Willher seeds mer as Fulas Flex B. unitery freher per que forme a Fulas. By thing from
her to defend the first that the first former and
hydromodes demonst lights. Since \$50 to a
militarian demonst first that the first former
hydromodes demonst first to be selfher from the first that the first former
harden, further When Press Art Math. Conherd many others of region pressures.
Here has that a first that the first that
had many others of region pressures.
Here has that the here the first from maneral
had many the best to be a first from maneral
had many the best best houses for first that
had many the best best houseful for them.

#### 100° Increase In One Year

The transmissing of Power of Will on a possing trace while like which the transmission and within a position. W. M. Taples the soled Military of position.

#### \$1,500 to \$40,000 Yearly

"Three years age I was making \$ 500 a paint and working deal and make \$1.000 a paint and her was to the things as red I to the house to the Alexandre Maria all paints of the house to the alexandre all Will up I was the application of the paints.

#### Worth 13,200 to \$20,000

"From what I take appends step I feele is I run gut \$4.000 to \$400 to see a cor had good out of I a P bus a step on Append North Wanters to be I am a daybeat to puts

#### \$807 Profit Piret Wook

Promps of Will' in a re-resultation of staleholy listens. At these work tendents in stalehold in stalehold in party which has been practy great which in P. R' Heating, U10 Tribute Mily. Change His.

#### Another 50% Increase

"More than a state ago I purchased Province Vall' and I firmly believe as a valual is afrom-the state of or or increase up making more than the ber best on that that "---E. C. Hadge or Province Magaine Constitution".

You may never have such a chapte again. Act now! It has long been hown that the weather as need into a wonderful tier end or his long. But out a cue men has a leavned for homose was unusted now to have held will poster. and subtreate it. New omes caddo k who has perfected a simple is returned r aree of training by which YOU can be of a an income a series of Mill bases on a prost protough and exemptific analysis of human haracter.

has palled thousands out of the dough of despondence and set them on the toad at not term and principer a. It was do the same for longhoung and old men alike to unity. The a most magnal changes in their fives after reading this great brok, written by a scholar whose same ranks with such leaders of thought as James. Bergson and Royce

### Send No Money

I you mus this great opportunity you will surely regiet per dy be therefore with requests as soon as his a correspond upration. Power of War operates 400 pages had trather poly top leaves and includes more marrial than malls correspondence courses selling at \$25.00. Fill out the attached coupon be it I you are not estimated that it is worth its wright in gold to you. Or, if you want to own it, simply send ex-It on the Low Introductory Price, and it is yours. Sent.

## PELTON PUBLISHING CO.

14-8 WILCOX BLOCK, MERIDEN, CONN.

#### Partial Contente

The Law of Break Thinking The Poter I serious up which u detende

How to develop unstabled PHERM

Dow to think all around print wallifers.

[New ter latine he mind in a delinemate in the national provided as included by

specialist clinic transition lines. freet fid that a starrest fill today

then as projected the Power of observers or Thinking. Describing Assignic

Most to acquire the shill of a root we Welling

How to supply hiteland proces-

Have to deter from the hilad all gawelessus bringhts

How to follow upp this of thought with time, conemployed Proper

Here to develop blatening Jone Wrent

How to Handle the Mind in Trees to Third last

The water of Hulking Wind Pages

Show the Will is made to act.

Show so test poor Will How a serving Will in Musice

ed Donty

This is early a courter fint or execution that in even he would almost All this poly

#### Pelton Pub. Co. 14-8 Wilcon Block Mariden, Conn.

Gent etten Please tervi me a cory of Power of War on approval 1 agree to musit \$3.50 or remail the book ir five days.

Address

## OUICK-ACTION ADVERTISING

BERF READ RS AND ADVERTISERS MEET TO DRANKE BY STATE

Rate 25 Cents a Word, no discounts.

Advertisaments for the April Issue should be received by February 1st.

#### AUTOMOBILES AND AUGUSTONIES

7.0(a) hill by from AT 00 upt Strendy of John Brath-wood, Athen ones, have a secur activable, double table three. The are practically procure pt adapt guaranteed 5 000 mags of 1 6 00 405 FT 50 524 3, 48 50 3, 44 51 00 524 3, 48 50 3, 44 51 00 524 3, 48 50 54 54 55 50 54 50 54

20 [4] A · c sentre word or place), remainmin provid. Bona Fide inclining Altra 22 Institut Avenue sing laboral

a NAMES NAME AND ADDRESS OF THE PROPERTY OF TH

Advanta Present tree tiers for all the San Steel Berm, he sakes granfighteen Ab the factor deter Philade the 1999 to assume on A the Williams plants to

Philodo the units to be the construction of a date been a fine by the construction of the construction of

States and constitution of Largett States appropriately 19th on provide Appen Spring and to be consequenced Apple personalizate provide Landon behaviored for

Serigible on open armor his automo be break distillate fathering out to provide the fitter area also distillate fathering out to provide the fitter area also distillate to the mile from the transmission of the mile from the Armonistan Armonistan Armonistan areas are supply to provide a supply to the fitter areas.

The state of the s

A 19 h h price Plat he better 10 of brahn at turers that price Plat he better in ready turers that price Plat he better in ready turers as begind that it will be a subsection of the better that is not a begind that it will be a store to produce the better and the better to the bit of each of the better to the bit of each of the bit of each of the bit of the bit

Pages. Repeate 4 of \$\frac{h}{2}\text{Person}\$

A Z \$\frac{h}{2}\text{Person}\$ of \$\frac{h}{2}\text{Person}\$

A Z \$\frac{h}{2}\text{Person}\$ of \$\frac{h}{2}

person it sown

g orly and T see, inter- action for Automobile Trees,
personal position and double mileses of any care.

Absent position Asiation free Absenticing Advancements

or Court 17 5 in our tibe

The Total 17 A million this the The The Property of the The Total State of the Total Stat

#### AGENCIES WANTED

32 500 5500 \$4 510 5 5 trans. Spresberg 07 f adeq Marset Lambian Bridge Stratzed to the Sole in the Approximation Mark a Secremental and the rings a constraint of this other articles who is recognized to to the wife bridge good results. Manyers referringes

#### WELGING AND SOUBLAING

It N'T every alternation parts. So a hear with 27-2 continues. New artest 1-and supplied presents and and depring companies are used been alternating parts of the case there welding a meaning of the case the case there welding a meaning of the case the target of the case that the algorithm is a first three parts of the case that the case of the case that the case of the case that the case of the cas

WELD No PLANTS, 435 00 to Even on Designed for all surposes final roads beyings; includes their size of the street bare one. Hermis Welding a Charles I. 5 4

#### TOOKS AND SUPPLIES

ATTENTION Just not patent applied for Greatest Combination Tool event deviced. Allign of Wrench. Angle Espain Server Street deviced the Combination and Server destructions and Combined to the Combined of Principles (and Combined on Caloni Mixte of Brase and Server only Mixte Process of Combined Server only Mixte Process of Server only Mixte of Brase and Server only Mixten on the Brase on the Brase of the B

#### PORD ACCESSORIES

FOR the plant many in mode weather. Will run 14 miles per palls to be foregoed describe in half has rape discovery 12 miles and the first product, and as as is form properly fire product as a first product. The product is a printer be described as form the product and are first and the other strength with a first product and the first product product product and the first product product

DESCRIPTION OF STREET AND APPROXIMATE PROPERTY OF THE PROPERTY

Trade to 1 of a man make the de per The district of the second of

## Is the Rate Too High?

Popular Science Monthly. 225 West 30th Steed, New York City.

Gentlemen

We cannot afford to do technul the new business we have been getting through Popular Science Monthly agents each month. He have decided to continue with you indefinitely, for inquiries from your magazine cost us only 5c, each while inquiries from some of the other magazines we are using cost as much as 60 cents each. We recette REAL answers from men who actually buy a stock of goods and come back for more. The answers are from a wideawake people who seem to have money and who are not afeata to invest it Cordiatty.

HOME PRODUCTS COMPANY

he me sear de thick the tate in P. separ Science. More than a Brown to be he will be had been been information white we

the new Adventures Manager POPULUE SCIEN EM STRLY T & West 1917 he need New York Car

#### BOATS AND LAUNISHES.

LARRING And Rate Finaled parts for pat-

#### TRADE MITIONS

THE Watchman he and Exemptine Feb 4 his todal beet evaluation of the 4 to the Wirel 17 Market han Francisco and result

#### MANUFACTURING

To Coder And article in mortal models took put-lesses expension on manufact sping incompletes de-related is sixed specialty and Manufacturing Com-pany Christiant Onio

#### MOTORCYCLES, RICYCLES SUPPLIES

MADTOR 3. Est all makes, \$25.00 up. Now not relegant the requestion when the fact the fell up. No. of the matter attachments and the fact the injects product the special parties of the fact the fact the fact the fell up. Now period for the fact t

Hime a 3 more so y less at Boar cost of power troughtures. Western for the agency, in the fact that Western supported Combinative A 3 May up to attention, then the Contractor.

10 this is transmissed to appropriate the trenderson I seed use the best transmission as we had been there is not under the seed to be the se

At 7 ofte her fitting to we white private are her large as no op house Party and about 1 considerate in the second Party of the second state of the second state of the second state of the second sec

#### KIART PROCNE

the [4,4,5] on also have turned encounts, which do institute with manifeliar, paper [4] in the real of the line of the supplements of the 12th beautiful (semillarity) without

TAKE The Patterion Plumple practical testractions.

white due print. 26 cents Philips. Makes manpany finits.

Mapor

3. And contact moder withhird disagrams h & 3 phases. Mar delta 2 to 17 pages to not 2 contact \$4.40 % and 2 to 10 to 10 forms 2 to 10 forms

ay a rain.

Of the Sitting of the War are manufactured and likely open trians and make the high arrive a manufactured and likely open trians. As the control of the state of t

#### AVIATION

AFRE AND I CO passenger are marchial medica-ion is an if I are so properly the part had been because I are business in part Bon Saw Yak

THAT unascential F and or dead create highers now country recognize a therefore of picker. The latest most of a property of the property of the reformation of the re

NAT T Hel descency toloropy contractly for nor Free Hillertenant Sale Block of the new of the prior of the prior of the first toloropy of the first toloro

M. I cart of high M that A subjective Airelance obstruction may very grand a disc is noted for any
of six fights netter also be from at home Subject
Waser first Migner Schol be from at home Subject
As a sense that Migner Schol be from at home Subject
As a sense that Migner Arbeiton type measures described as should
be confirmed from head drivers by not necessary and as should
be confirmed from head drivers by not necessary and that speed
As tweeter represents a subject of the confirmed
As tweeter represents a subject of the confirmed
The Abstract charter through the action
The Abstract charter through the action
The Abstract charter through the action
The Abstract charter through the action of A

in the Abstract charter through the confirmed through the confirmed
where of the law has been action to the charter the
Review, higher

Parter, . Telegraph.

#### WIRELESS

FOR the ampieur wireless man. The Radio Aquatons.

SIND PLE. Wherever Triesph new and he in Night There A great back for the advanced radio acceptance of the articipate reportant in and use of he wholest triesph new Price County postpath. Hank frept. Puppelar Science Monthly. 274 West 19th Street, New York.

#### MOTORS, ENGINES, MACHINERY

MAY CL. Motors and Generators from tacking-up and Pictoropic saint. M. So of all places of proc. in-Burdant delt ers. Seed date, you do procise the can-pley Ad. it page 134 Johnson West Last. Ficto-burgh, Princeyes and

for which the curaban post based the postables, and the control of the control of

Late V PRANTH Stands Stands Bond, on and Positions.

Completed S. F. & Windstein an out S. Standson.

Section 3. S. B. & Windstein an out S. Standson.

System one Victor 1924 Normalis and Internal Space.

500 heavy duty by R. P. bestupt, Coneral Electric Mathematical states of the phase liquid files from the phase liquid files from the phase liquid for the phase for the files of the files of the files for the files of the files from the files of the files for the files for

#### KINDH THE HOME

Table N Fill Calle of the space of the part of the space والبدود والراب

RATH J at a Chippen and alternia the dark. At anh the to hear at a hear and the find addition from the find the first and the fi

#### LABORATORY AND CHAMICAL BERYICK

his is the print parameter to be a state to the ball of the sale o

#### FORMULAS.

Dough Collecting to the remain of both problems that it is the remain of both the remainder of both the remainde the plant of the state of the s

476 Openential to-may-inniting formulat and trade cycle. Postable 26c. (25c) by see. Wite-harded ediane.

1,000 Monayeasting Formula suly 24s. "Lond," 2001 PH Morth Mobey Chhage.

for Persons all case the cent there dearest noticed the Control Religion College States and College States and College States are colleged to the College States and College States and College States are colleged to the College States and Col

P 1955 A few weaking at stage his sets per our to perfused by metadosina 715 a Sach 10c Atomics to Looks Missespi

#### OFFICE AND PARTURY LOUIPMENT

14 T. D. Despite Anti-transplant M. P. open Supplication, P. Mariero, E. pero etc. H. apit stee, for h. P. net the Children Supplier Company 32 Secretal Madeals.

#### TYPEWHITEHS AND AUPPLIES

ha) W describing a survey and aligner is timed. Exposured opin \$6.46 align: Part of Alienth Res \$1 app. Writer has the factoring 2544. The surpress property of surprising the Western We make improve received a feel bagger.

#### ADDING MACHINES

W NOTE BOLT, Adding the time of an endorune co-parity on the dellar Ad and deal release as gast as the diagram with more Thompson being what he agin demonst a on I. I Juntament tempony they be Og len,

W R 14 th to great the a control whose the arrestone new first one but up blockers the adm 212 50. We give unitable fields may three it we come it we have Weste the trial offer as interior to enterior and the Committee of the control of the contr Raustin Stickion.

#### POR MALE

A CRA 66 h to pin the distance because the error of the e

Western migrio Farre Laprin. Herd Strainer States.

#### DIAMONDS, WATCHER SEWELRY

RGFT Shiet Links and "No Fine" connection: quality marginteed l'omplete in gift box, fire War Tax, Sc. The Chil Rate Jawelow, Perussian, Penastrivine

WH & RITTED BY that County for a copy of her type is a series of the ser

#### LANDY

CHEFUL Super a house of mean of mound but it a partial goal permits mounted them is a ever as set at each processing. Their like Lab story is 15th attract. Photoschiphia.

#### SPORTING COORS

Trillands I leaded Fraking Lary Whose states's supply one delta: George Julian, Albenta Building, Buston, Mussechustrie

#### PRINTING, ENGRAVING, MULTICHAPPING

Colorett Pressing a 1-m oraces of the good incombinate march on, march tellimeter 1 etc. in the first in the colorest part from the absence to colorest against the first colorest part of the first colorest colorest against the first colorest part of the first colorest colo

A STE HADD In on hald business that ordered at add offer to adjust over the Property of Laboured Laboured Property of Laboured Laboured

Delivery Description Courts Francisco.

as The All Tips were as enters bead on these body payments with \$ . We grap the \$4. \$ 4. \$3. do not be lighter with publish 4 headman become, \$3 demandates Will also

5000 Gainmed Larvis, \$1.80. Catalog. Irwin Well.

PRET entains of Scene in asters that will benefit your storm. Royal Label Company 37 South Secrets. bight cope. It. Phils, belvinse.

160 Chrete, britaine, productional of our similar. Institut rand one, for 40 cents. M. F. De P. Fineraring, Rubbue Manga, 34 Middle - set see

230 FINE LETTERILLADE, on per and all to the period of the

FF P1 Alle E A world number that spend by Ma Ca to

Property of the State of State of the out of the TIPTY was ease marts by a find his good diffe. Charma

S SISITING Parlie to appear a de terral destruction de la parlie del M = F7 54 M. S

#### ADVENTISING SERVICE

If A 10 II is not return and resist in ref. 5 our makes before 5 reports upon a 1 our part II.

Here is now been A to 1 North art. Note actively that the tenth of the beat actively that the tenth of t

A to introduce the flat distances as about of the first and the control of the first and the control of the con

Allo KINT HO T IN Want Surring months for that your \$1 to \$1. I had this Arction, \$100 ag a West Surjan. Suppose Ad dress Will L. L. ann. Philippine 770

ht blaff by 24 water the mentactors II I fate from 200 for see, here Montactors Stateling, Pitter branch for plants at the property of the plants from the part of the plants for the plan

NER Allender III And A class for a course of the special will be a recovery for II where the class on security for a subject to the class of the security of t

fil) [4] [sub postacher manne] cample. Par is state dissipatestion, [ Olivier Symplectic, Assistant S. P.)

#### MENCRELANGUE

5. 7. FRD 41 Tailroting \$20 Pine 35 US and UP 6 May for the manager 3. H. Temper 1019 Niger Pums (part well 1996)

Phys. J. No. Careered All sphints found remains I happened before the Parket All and the North Late.

BUT STAIL NAME Indiana parter for growing their ne-ing surrows. Private has maked but by the final mixeds, 100 Keel Add survey, his has been York.

#### WANTED

May be May married on an even flor on its the bearing to store I want separate blooming 225 most stop between New Y B

I and the text that the court. We pure up to the fit pure up to the fit of pure up to the fit of the court of

Win N. S. Avidel gan to and stour despitues. The property of the second Fram.

to the function, became the case on the 6 7 6 56 tel bestranger of the same arrelation to say it. If you a good for said to say it is stored. Best in the same in t

#### DIFLE ATTING DEPHES

"MUDDERAY" Dupt enter- y beat mas elector. It is no ish to In copies from year, named, typewriter, so give of celulus 15,700 prior we I like darw trail. You made to be as a we I w Linguist & Receive outposes.

#### INFORMATION SERVICE

TATE OF TATE A specificate Afficiation was

To Hill a Chillian I will be deadled to the a compared the spine to the state of th

#### CAMERAS, PROTOGRAPHY, SUPPLES

\$4.6.4 me pure with any mine fight for development and the velocity product or some dis negatives any able and for the six persists. We would use if one is if no united changestands in single profession in a distance. Photo beads up to the feel distance, to show him up.

Fa. 5.5 the ellipsed of really parameter for smalls. Plantas Paperson later No. 1 State - Specimen a later.

her of the plants read one this disterior our bin has an are on the bitter to been said early to the high high at Photography Inc Pope building, from a Massachum is

the the host his our management of the force of the other o

Indicated in the new relation. no settle of Thomas . Philips in metal of the completion on to write the information to the company of the part of

#### MOTION PICTURE IDSINESS.

Market make he was to press of most fine of the distribution of the second of the seco

to the test and the second of the other to the second of t

Fill of the 18th Mandal Dali prices of the real series of the 18th Mandal Dali prices of the real series of the 18th Mandal Barbara to 18

#### AUTHORIS MANUSCRIPTS

THE A WEST OF A WEST OF SHE DE ARE OF PRINCIPLE MAR up to the experimental states and the second an

MAN AR TAX power team interest and a part devel for head of it should recombine them to work in Such Nathern

Bur t B's a negative by the committee there is not the committee of the co

to a 3 for heusespeep and sentanties. My Pay For we unaccounty details from Press Sententing at a such on Lands.

by distributed the product of the pr -44

The first state of the state of

#### DERIN ROLLDA, PETN

principality is a recipied to a proposed to a pro-mit safety to a different point of the model to a pro-ferent from the few of the point of the proposed in the first to principal and the second of The product

PRESENTE Congress Production par the Fartingare on Bird Parts, Lymphaven, Lymphaven,

#### FIRM AQUARIEMS SUPPLIES

Class College Inspection Topics and College and Constitution of the College Inspection College in the College Inspection Colleg

#### FOULTHY.

Print TAN Paper for your Thomas Hill Sample for Rate to be a few sont paper for Postury Advanced for the Sample Advanced for the Sample Advanced for the Sample Advanced for the Sample fo Postury Ad-

#### PORFIGN LANGUAGE STUDY

THEN special Englis in the sec in these in your captures to the second of the second o

#### AMBRICAN MAIR TIPES

A THE CAN STANDAY TO THE ACT OF SECURITY SHOWS A REPORT COMPANY OF THE ACT OF SECURITY SHOWS AND A SECURE AND A SECURE AND A SECURITY SHOWS AND A SECURITY SHOWS A SECURITY SHOW

to be I to be 6: 41h to the people proper light of the people proper light of the people of the peop

#### AUSTRONIERS

41 T ONFERS tishe of Control Prop catalogue Corponer's Austin School Ramma 277

#### FOR MEN AND WOMEN

A ARI 1779, elementers, attention between patent, partent gazeran redler ridle may intention bette into belief in the course course for the course page 198-35 pageing J. Herman et al. 200 for the course page 198-35 pageing J. Herman et al. 200 forces.

Calham, Highland Springs althous. Whilesale

NEEL AL Phabas phy life Class specific on his management and configured Fired A formation and configured Fired A formation in

CET About Cats to set stands and mer representative and many an personal better for a subtilibility of the second suppose, we also saddle is sub-BUT PLAN A THE READ OF

BS a detective. Excellent expertuality, prod. travit, jor

CET vital attenuit. Retain somittel right. Wonder-nd results. Intensity interesting boothet tria. Withdow b. Chaor. Washington, 17, 17

the first of the manager of force particle where sometime hand being to be the manager of the first district o

a to glassicant dense hacerean lines on the second street on

odds awat of the to mile obtain to feel according to according to the total obtain to be the according to the total obtained to the

1 pt to the flore open to the herman's day members, he is to the desired of members about a spat to the qualitation of a state of the spatial of the family for the family to the family to the family to the family of the family open to the fa

RHAMPI, France: These Spids Shampion, Lie & R. Tab Products. Dept. 2, Farmingtale, New York

I ATEMP thing a Cull Links, 50r brings except pair ingtold & Droglas, A. Lebner, Manageparity.

#### MUSIC AND SHEET MUSIC

The property of a second control of the second property of the second property of the second property of the second property of the second sec

por a W. sees home accordingly there are a real tion distinct for all, it is or to at a short matter between the con-Ci. Williams in Uniquency Linguistic, inchanges in the Ci.

to Fig. Talenti Company, Muse Publishers, 722 West to a most New York City for published buffers of the heat best walt mint. Appeter September 10 and the mint had been noticed their sector for personal fire sector and election office chairs seem for personal

The artiset and electric richer electrons and have proposed for a section of a sect

#### MUSICAL INSTRUMENTS

tach spile a se Tromboulets There Espelan esh ili high token Springen Corpes School Rehigh teams

#### PHONOGRAPHS RECORDS NEEDLES

per order or death collection in the environment per order or death collection in the environment of the env

as not choose spends parter on buch mall representation to the first transport to the Debt of the Monter of the Debt of the Monter of the Debt of the Monter of the Monter

#### GAMIS AND ENTERTAINMENT

If \$3's requirerable arts consists or dealest to the page of the consists of the page of the consists of the c

the or a constitution of the state of the st

The ket and decided by The a greenbacks by the Homeon I won't service

Choice

The This property bear inscient and a second secon

it a 47 s. As had been some a feel as being some of the control of the property of the control o

66, Alleiebeith, elleichtlin

#### STAMMERING

per at 1 to the four from the chief the first of the per at 1 to the four from the chief the four to the first of the firs

#### EDUCATIONAL AND EXSTRUCTION

Appropriately Made Easy by the greatest living authority on Shorthard Course birthard, anther of Mrs wants may shorthard, desired by experts to be the samplest the brieflest and main implies ever derived. Not being attented to over 500 superior endents of who do hap what a deriver and the course of the sample when a deriver and the sample when a deriver and the sample when the sample of the

STU is photographic ournalism. Page 87-300 to 85 700 to 67, a norm represent to demand district 2 to 2 course to proposal Particulars from Biologues court Patticular Wishor North architect

The supplement of the supplement of the supplement of the large law Mann. Blackman and Aradicate of the Land degrees granted back for Their Charage

the the graph to the provided and produce or county and only bearing bords and sometimes and the second to the sec

The Problem D. Sporthagen, Wange to be used to the ad-titute at the first of the State of the State of the same Particulars from Window P. Cham. Washington.

Parks a Notherthald fire on learned in 7 da a feet in a service are different ing in latered receives on in parties once in fault or all in the ta-bulat in Institute 64 desired Flace. New Orienta.

to be 4 A Mells I'm at the appropriate by made and area of the tree of the transfer. Management of the tree of the transfer.

the first to be pulsaged through a fourteen frame to be pulsaged. Approprie to be frame to be found to

#### BULLS, BATATU APARM LANDO

First transport of the state that a line attended in \$2. The life of the state that a state that

Started 3 S. Sh. S. I arrows 1 in a case of the ser from the second of the ser from the second of the ser from the second of the series of the

I do high ratios from gate wepter for high I. M.

by 1949 Party for his Party. The player of little recent is an ill how health of the recent is an ill how he had again where the little players in a second relation for the recent is decided in the little players. It does not be go as at Property and the little players and the little players and the little players are the little players. The little players are the little players are the little players.

#### PATRICTS POR BALL

track Fit of Philips a common Parcel for an inner be seen to for anything a rel to beginn at high relation to the seen to the anything of demand of demand of the seed of the column to hear bearing

I R under only the same transform tentered for fortishing action and allow thought to dealer one person has a ring on the approach forms Harmington Half-lifewise tenter

in his was few process; moreover making harvestone for

#### PHITTERIA AND POSTCARDS

A 4 M A or its Period and Pleasure on the line and Parties from the control and the sea from Maria and Pro-ports an expectable Horizon Zama Labora Assence a barrago

EVERYTHIST in measure To-te-date lists flow to a show employ Signature subjects professed. the as supply a surject Publishers, Brack ed. Penn-

A P Reporter than it per speed in this process to the period of the peri

classias to a few section of the property of t

Art viget in his action of the Walter Strate.

#### INVENTIONS FOR SALE

POTT OF BY THE STREET OF BY AND STREET OF BY STREET OF S

The third is the property of the standard of the marks of the mark hus en h can be a major for the second of the second of the second of the transfer of the second of the secon

#### STAMPS AND COUNT

NEVER And One owns uptar you ma our r oppropried that Thintrested cate Value Pauls. New full con. above his mark process we pay 2 in 10 paid for 1884 there is being the day. You may have variable come. International Coth Co., Box 151-14 Painternational Pauls Falls.

4 1 194 4 gold quarter size To 5 size 55c see we and catalogue 10c Varience Moults. Along No. Man ora

d'Austrie William William North Bot stant Canadog value 9" only for with the creat approvate C. A. School West Cost Sant New York

Antherings damps the the 200 25e Augustynia

31 charte over on every to a Planting by different British Calenting, Burkey I as a Bowen to on, this

FT & 1100 Al different wise interes by Line type Finding a Part Stage of March Wednig-ths affect Land Stageton and Anti-

50 I tests at attaction to be sended to beautiful brown and for blood a service of the sending brown beautiful for a state of the beautiful for a state of the beautiful for a state of the sending for a state of the sending for a sending for a sendent for a sending for

A consistent oresign which the Article Was returned betterstarted the warmen of the terminal of the control of

300 HB-front Stanigm Star 2 front Stanty GON THEIR HERSEL

effektier o til offeren i centa Sienthon paper Quality o map o foliati for

5. So from point for Standards of all points actes before an event in which at owner for new like to ed in which at the IV I is the same too one to be an expert that You are

t in exterior fatelies storing 200 F 1 4 hane).

A to a seed upper and a constitution to a seed upper and a seed upper and

1 100 5 4 Model spine of all soles of a salest the salest the salest the spine of the salest the sa

A is a define to being the position of the first three to be a second to be a sec

to the to server to the server the file of the file of the server to the

when I are manifest that Catalogue of sides for the flow analog on as pure-section to solve our when Malington switch and Resemble Missard Sheph P Brailing & generality or a

#### FOR INVESTORS

with Mechanical Manager apartition is the pulliple of the second Manager apartition in the second Manager and Manager apartition with the second Manager and Manag

had been deen ger menter i trensfert oburens brand to englis Ciprode top 3 Mysisterans 7n stord. Bur mee'r n address. Classified Department, 174 Fujisan v ben York. HI

The state of the first free that the head and the problem of the p

HAND IN A process of an enthuell to sell streight place on Peper would be also for Adams Flaher & S. 12 M. Free on Alba in the calls of Containing

Hered were in the polymer Manufact from Science Fuller.

March 16 or 1 to 10 to 1

The Mile Bin's Read Three trade To a certain the state of the state of

The second before the second has the second with the second between the second 51 h 4 P B 9 Ph

on and an letter extract of many or of all the problems of the party limited from the party Promise in the service of the servic

1 h in Technic andre Set to be livent de latte marion free d. M. Gestell, M. Chattenhain Drive Buffajo.

INTERTATE THE TOP THE WAR A WILL HAVE TO THE ARTHUR. The Thomas I and

DIE TRETEN'S RIGHT MARGET IN F 1 to TRI-TEN'S Winning Manual in his design of his process of the interpretational for the interpretational in the process of the interpretational in the process of the interpretation of the interpr Training for

Head and

the Automobile Center of the World is the Logical Place to

There were 6.353.013 cars and 100 Mg Trucks Lored States of Figure 161 2529. Three-core are being a whol to his astounding of every lay until the number of now well eight main mark betwee the end of the cear alle of the deman I setur a set at reduction And Detroit in the Heart of this Tremendous Industry

Big Field, Wonderful Future

of et at

Earn \$100.00 to \$400.00

has no a use of the reasoning in agric and during bounts. The line of the Construction Stat one addressed for any ery are attenued to each organ and then. They have a period or imagent anaester on the businesse.

ENDORSE THIS SCHOOL BIG

The homoghnous of any motivate and the completerance of any equipment are not placed in a fine to a place to the contract of the contract of parameters in the fall to the contract of the con the but builds. The pageon fact stee in the course has in on one and then discount the challen of the course of th



Manusca Murog Lovens

DETROIT MICH.

Mr. James Williams.

28 Interim the size requisite to Y.

Spens the Y-ray has to the seconds to Y.

Spens the Y-ray has to the size requisite to Y.

Interim the Y-ray has to the size of the technical respect to the payment pool to the half of heart representation against the half of heart representation against the half of heart representation against the half of heart representation and the payment to the half of heart representation and the payment to the half of heart representation and the payment to the half of heart representation and the payment to the heart representation of the part of heart representation of the half of the payment of heart representation and the horizontal representation of the payment of the heart representation and the horizontal payment the payment the heart representation are that the state that the heart payment the payment t

BING MOTOR CAR COMPANY

Blessy Goods Strange agencies



THE THEFT D. S. A. STREET AND THE PROPERTY OF S. A. STREET AND THE PROPERTY OF STREET AND THE PROPERTY

This is a Platters of One of Our March, 1915, Classes

#### Equipment Best Obtainable Course Interesting and Complete

In correspond logarithment we have from 20 to 5 cars coming or all to work the hierarches with that of the of ble experience in act in known work. That block est Irport with him exity different type of contor with which associate made farmar. Other event mount in causes hasses of various scientar leads. Extra essent alfeer stellar livereds, bothought life L. Trest at some are complete and over aut a truck and tractor business.

Brazing, Wolding and Tire Repairing Tought

Complete senar te courses ga en un bese se gecta By zers and we been get \$8.00 to \$10.00 per day La mes and gar get a ways need competent men Also ag spourt interviewing the section of those

Start Any Time—Earn While You Learn

School open all year. John or Jasses any type. Three el sers a a muse og afternoon even a. Instituteds re members of The Society of Automotive I names a 5. 3. f. r. Our graduates get follows on a 11 mercosa y we can see see a ork for you to help pay expenses while

FREE—New 176-Page Catalog

part recolumns eller equipment sports homens sof-



NOT A ONE MAN

This mount is descented on he begin morel proper at and question letter place up for the more appropriate to the free all of house to A. I. El .L. R. Premient)

MONEY-BACK GUARANTEE

We guarantee to qualify you for a position as chaoffaur, repair man, tester demonstrator autorioririesan, gurage man, automobile dealer. Acrosplane tenter mechanic or tractor mechanic and operator, paying from \$100 to \$400 monthly or refund your on orders.

letters comesa isher graduares, storens of terrors, non-factories commending or rechool and methods. If our one case of graphial with over the world proves that it outwite come to the Michigan State Anto School Detroit — he Anto Center-and learn the business right in abovens most estap to work. They come to revestigate alozens make stop to write. They come in anyempate personally pressures to start at once and not one has been disappointed. The strong man and taken miles became an enthusiastic bludens, induced others to come and since graduating has made a hig soccess in the work. Y so can do the same I you mean business. But don't delay. Use guarantee protects you. Jump righ, on the train and come at once lif you can't come, ask for catalog. -TOD \$3

Yout Progressive Auto School in America"—"In the Neart of the Auto Industry" 687-89-91 Woodward Ave. Detroit, Mich., U.S.A



DETROIT

THE MEMOY OF THE AUTO ADDISTRY

#### PATRICT ATTORNEYS

Fally Night 11 year have an investment which was made to patents year and write faily and free 1 to 5 and 4 but advice in restard to be been we of decaying probability of medical and antiques at a fivelest if 2 of medical patents and antiques of a restart to a restart to the restart of the continuous of a restart to the restart of the continuous of a restart to the restart of the continuous of the restart of the continuous of the restart वी अस्त विकास स्वत

A LY Patrice owner. The book the ancester heeps or mer

First we peak a sile Mather. To be the many peak properly explained over the new to be a peak and the train the second of the new to be a peak and the train to be a second of the new to be a support. The training of the second of the new to be a peak to be a second of the new to be a peaked the second of the new to be a peaked the second of the new to be a peaked of the new to be

PROTE: T your rights. Write for her on it to consider which contains forms to addition which as it composits a special forms to properly a special straight forms to be settled to the set

bit he had never to the set of the conof Thurs in the set of the coninstant and only to the set of the set of
aptrophy. Find the set of the set of the set of
aptrophy. Tallers at the free to expense
After the the free the free to expense
After the free to

P Is any images 6 to a di let had begin to be and the total and the

The manufact of the policy of

parament of the transfer of the state of the Proof of the transfer of the tran

by S. P. L. or y to righten an posterit production. Markety
day easing of the north supposts mend for blanch force
p top to a file to a to be depresed and witnesseed
the day and the state of memoring paths for the state on all
the top the first part of the first path of the first p

Phil I'm prior read about Banks requested to a processing of the section of a processing of the section of a processing control of the section of the sectio A 2 2 to prove trees of the averages of the color of the

PATYNTH, printips porwhat, efficient service by an A-tisemen-subject whilled in all branches of Patrict practice to a positive in a process of the process o

The state of the s

CA PATA Herbert Armer, Patent Asierburt and Merhania er HE F treet, Wantipprop. D C per of a person was be had and its react cont. Pend

Pin A. Portmont word man. Three new Notanes

To ENTERPRIADE Advisor and from on the control of t

The first section of the first

PART OF A PART OF THE PROPERTY OF THE PART OF THE PART

Part in the state of the part of the state o blank T based

property for the property of t

"SUDMADING to War and Penes," by Stone Late." the subministive inventors. A thirthline group of set is a fine hinter of the files. The There

FA ) T applies one libration personal parameter plane in the order of the parameter of the parameter plane in the order of the parameter plane in the order of the parameter plane.

PA by the Browning Proposed Personnel except and adversariate accepts and adversariate and the state of the s

#### AGENTS AND SALESMAN WANTED

The BINT agreets Weakend Big recogning amount much and care for Jen's acquire to the management of the second of t TART BINT Agents Muntal Big remplete many

The Course of Francis to any other broke and 44

To To a series of realist to recovery title better

some Bang Server Our F nation ? THE RESERVE OF THE PARTY OF THE

The same of the base of the same of the sa To - John D To D State agen Age p A you in the bit the water to parel supp Comment of the Parties

of the sill became to the state of the sill sill seem of the sill sill seem of the sill sill seem of the sil

been to be a first and a first

the state of the s

A S F And a She had been been a produce to a S F And a She was been a produced to the produce of the state of

Ad a.s. I gard here. A or result disk is printed on the printed only and deposit a tention of the printed of th k printer

RFIRS on an electron promote of high feetiles. dilips 6. Wheel N.

part is the first game investment as the first and the property of the part of

A VIN big books in an event brought at larpool in regarder or Fin over him brothers to
the back for Finish

Fig. 5 I Vinished to seek him or large farth ore
aget or term begange or or or to the form of
the or or property to the first property of the first proper

Ap the tree on a spate thing spay arough here
Types and here to all all are a province of Phrydea to the tree of the tree of

A sippe good black per seemen of many to the phart lamb of the part of the phart lamb of the part of the phart lamb of t

and the rest of the collection of the collection

The state of the s

At I buy's grade for etals and y also the or the or

A series on 3 to be been sent to the country of the

the factor of the factor of the particular property of the particular prope

BARY pleasant that, for machanics this Note, here, there is no district that it was also as the control of the second and the control of the

the VICENTE Address Variative regions destruction represently remains for any destruction with made of a horizontal state appending productions of productions of the state of

A the same begans to be an interest to the same the same to the sa

The left can be an ellipse a grave store have an expense to receive about a second descends, adopted fourth or replace a united and thronourism as well as Patient, in the date of the replace and a grave of the received and a grave of the received at a grave of the received at the recei

Bi, a

the search of th

plot to the strain or to the color of the strain of the st

the street and tiff on I will make \$500

to the total age to the property of the proper

Fig. manually flux map if argin plant if it is a set of the manually flux map is a set of the manually flux map is a set of the manually flux map is a set of the manually flux manually

The two fivings done when day to ret in the training agent to pring a later shapes a section. The title significant is not a section to the title significant in the title significant in the section of the section in the section in the section is set as a section of the section in the sectio

the property of the property o timps.

to experience to recommend the transfer of the property of the

I ver plan in many grade to a product of the produc

The state of the s

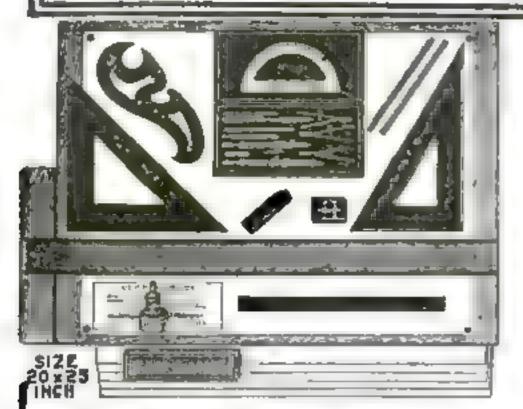
Per O to the low so to the state of the stat

4 property of the result of th

I by a' or to condition the by W. for the or to the state of the state

N.5 par \$ 40 to mild a to abit almost vig abit ex-prises to a fundation of a set of the post-flere Bigler respons \$ 4 -- prospects thrown

## Drawing Outfit Drawing Table



## Complete Set of **Drawing Instruments** and Drawing Table

Yes, I will give you this complete drawing outfit absolutely free. instruments are in a handsome high class, plush lined folding case. They are regular draftsman's working instruments. Besides I will give you absolutely free, a 20 x 25 inch drawing board, a 24 inch T square, a 12 inch rule. A supply of drawing paper, two triangles, a French curve, pencils, erasers, thumb tacks, etc.

## elivered at Once

The drawing table is the "Chief's Own" adjustable folding Drawing Table, some so used and needed by first class drafts-The complete outfit and table are delivered to you at once. You have them to work with from the very first day.

## Be a Wraftsman Draw \$25000 to \$30000 Per Month

There is an urgent demand for skilled draftsmen. Companies are issuing calls every day for men to fill positions paying from \$250.00 to \$200.00 per month. Work is light, pleasant and profitable.

## Chief Draftsman Will Instruct

You Personally

I am Chief Profumes of a targe and well have been doing the highest prince on wer sandting work for a quarter of a constructed I know just the kind of to make the in demanded from men who go the control was I train you by giving you to said proctical track, the kind that you must be able to do to hold permanent, big payma poursons. I give you my individual instruction II your work is right I will advance you rapidly. It is is wrong I will above you where and make you do it right, and do all I can to make you in expert destinant and designer in a abort time.

Write today authors fail

## Pay as You Wish What I want is the right

What I want is the right

you the working outfit free if you get in at once I charge a vet i man leeful t among you to be an experienced draftmann. You can pay the small cost as some you best.

## Send Coupon for My Big

New Book

Put your name and address on the coupon or a fetter of a post call and send it to me today. I will send you, shooly sly free and postspand my new beats. Successful Print remaining on what you got the complete Draftsham's Working Until and Drawing Table atmosphilip from You common or no quations of any hind to senting to the coupon. Get in the for a large paying panels. Getting the book and full particulars of the special offer in the first stap. Don't delay—and the suppose today.

Chief Draftsman Dobe Britism List CHICAGO, U.L.

#### Chief Braffemen Dobe, Englanter Equipment Co., Inc. Div. 134z . Chicago, Blinnis

Without any obligations on me whethoever please trail your by k. Soccessful Draftsmanning, and full particulars of your liberal "Personal Instruction" offer to a few students. It has understood that I am obligated in no way whatever

Name	II h h w++++-	
Address	**	

WRFTISH You are to use to a salesman to a ran build a hardness with a permanent remains to his loss on \$5 to \$7 to \$7 to \$1 to districted explained to the problem of the problem

To de Serve Hilling and process out and profit or and real Transport of the server of the server of the Company I proper determined to the server of the Company I proper determined to the server of the Company I proper determined to the server of the Company I proper determined to the server of the Company I proper determined to the server of the Company I proper determined to the server of the Company I proper determined to the server of the Company I proper determined to the server of the server of the Company I proper determined to the server of the server of the Company I proper determined to the server of the server of the Company I proper determined to the server of the server of the Company I proper determined to the server of the server of the Company I proper determined to the server of the server of the server of the Company I proper determined to the server of the server of

At a least the partnership with the latter than the latter tha

Some the transfer of a construction of the form of the

rely 1 here of now the of now his and but a few Hardpotest a fifth that he had been to be the first than the best of the

As by 1 th the provide off our Physics Reports Seed to the Seed of the seed of

which has been one been a tentral and a second and a second and a second and a second and second and second as sec

All 4 le b de la company de la

The state of the s

the part to the part of the pa And the property of the angelian of the angeli

Physics of the section of the rest to the section of the sectio

The distriction of the property of the propert

The first of the street of the 

Since for may let flore. Surffices hand and Private destants, and a sed bid felt profits. West Furnish Capturest Colleges Colleges.

Interest Completely, Forester, Collected A. 19 to the forester at 19 to the forester at

A of 5 field change 2700 months in the manufacts of freeze the manufacts of the first of the property and represent the fact of the first of the fir

#### BELLE WASTED

The real density is possible of the ordinary spect of married to perform the form of the f

Filtres & Brahamer Standard Street Street of the standard Standard Street Stree

THE A S OF THE PROPERTY OF THE

The production of the producti

The Market Week to the Mark to

for a file or a file or to more I in 1956. It is the file of the f

The Principles of the Principl

He is the proper to be backer demandable. It was the second of the proper to be backer demandable. It was the second of the proper to be a second of the proper t

F Canting to I treatment thing hash

at a 1 to b b a dat upo or b for all the control of the control of

of Print of the second of the Print of the second of the s

The second of th

and the state of t

the electric transfer that is the experience of Contract the Angle of the electric transfer to the electric transfer to the electric transfer to the electric transfer transfe

The second secon

I have a light town types the T management of the type of type of type of the type of type

the light to the state of the last the

The property of the property o of the couple of the first part of the best been been

4.ETDX TID STAbil Experience encrementy Sensitive of the August Vander (the

The safe ten seeds to see the seed of the safe ten seeds to be seen to be see

#### property of the Cartes and the

the familial of the Pile of

ti h "Sail Miles" yal hij The parties where the parties is the parties of the

the state of the property for the party of the Mean of the party of th

Fig. 5 bears ashed once 50 tens found for two-decade. Phases a Moure Saving Find, 164 Central Avenue Repositive, New York.

OFTH D a prouder literates Phenomena and acres over had. First we did into the and or only the first and the little bits blood blooms. In the little bits blood blooms by the bloom of the company of the

first provide analog sergical Planes. We pay in the pay pair and serve in a last day to destruct an apparatus money with his hoppers Washington

will fee a 7145 to a note in any community wants.

The fee was seen with a last a out to make substitute to the fee to the fee and the feet of the fee

PAT T ou die neletromme be micht. Parent North, 56 Wurde netwin Dr. C.

SCHOATSH-Part respondence current at kinds for other Dodlars mixed Courses which Start hard I start that Spart

has of Domesh (size a sin) helps in Parce for in the season of the result of the season of the seaso

The day of the state of the sta

The first growing highly profitable from Supersequences of the first growing the first order of the Supersequences of the state of the

been doed and feller than provide attaching to the characteristic to the first of the characteristic to the characte

add on from it fram her furthern & come Wicking.

the second of the property of the party of the property of the party o

The Build's separate in pour beach and the glassing states and the separate in pour beach and the glassing states are stated in the separate i

#### BOOKS AND PERIODS AND

204,000 several-land broke for sale, 256 costly bindlags a read a part of the fighteen gift withing 1 of
the or expectations of the transfer at the cost of
the first operate that the first operation for respectively to the first operation of the first operation operation of the first operation operation operation of the first operation operatio

The latter of the second particle of the confidence of the confide s n was a hward no Tour's

2 1 2 M A distribution of the second to the a Magnetistic

in all more harms in his war begins and

The house of the books of the state of the s

THE LONG THE STATE OF THE COLOR TO BE A STATE OF THE STAT



21 Sowels-Rubies and Suphires

Adjustically the Second Adjusted to Timbers have Adjusted to Inchesion and Adjustical Paretions 2 - seed to the Adjustical Second to the Adjustic Entre in Adjustic Entre

## Only \$350 a Month

Yell pay on with a mind amount each month for the masterpasse sold to ye at the orient a but my see the owner passe at which a Pur light is a . I a matterpasse of watch matheta turn a adjusted to provide a sure or own era a cland adjusted to mothernism. Send the coupon toway for tree book on watches

## Send the Coupon

jun-	L 1. 3		T.		-		e 1	1 1	to great he de-
		à.	.1	. 5	a 1-	n <sub>e</sub>	1 1547	18000	Ann Lak

Burlington Watch Co., 13th St. and Marshall B vd. Chicago Ill.

Dunn		Wate					Chicag	ζO
-	4 7	*	5	1	41	bri	F ·	L
Name								
Addepsi								



Georgia surprises Minnesota

MINNESOTA, the Miller, brushed the flour off his clothes and lit an Owl Cigar. "Why is it, Georgia," he said, "that you are the only state that grows practically every fruit known in the United States?"

"It's because I have such a variety of climate and so many different kinds of soil," was the reply.

"Americans alone enjoy your

fruit, but your cotton is known all over the world," continued Minnesota as Georgia puffed his Owl.

Owl cigars are the enthusiastic choice of all the States why shouldn't they be? Their fragrance is guaranteed by a \$3,000,000 leaf reserve, and backed by all the resources of the General Cigar Co., Inc.

DEALERS

If your distributor does not sell these dependable eigen, write as Sanarath Con. 129 West 40th Street, New York City

TWO DEPENDABLE CIGARS



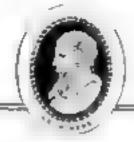
OWL 8c

White OWL 9c

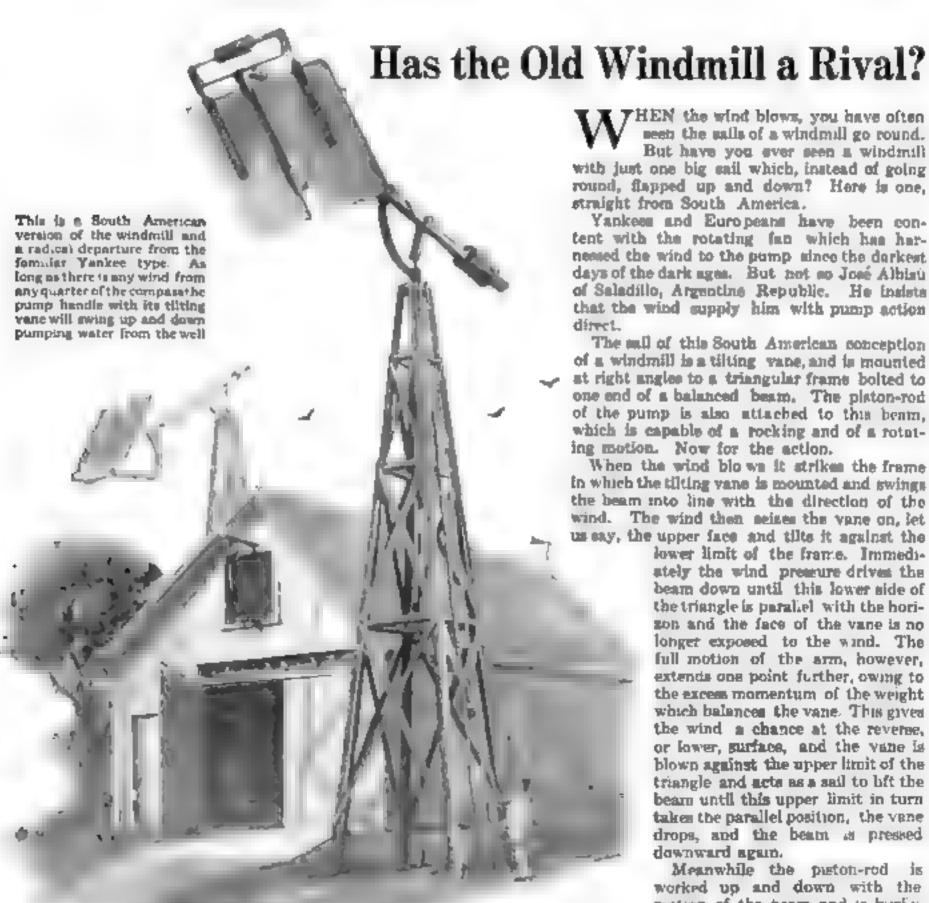
## Popular Science Monthly

Waldemar Kaempffert, Editor

February, 1920: Volume 96, No. 2 3 Dollars a Year 25 Cente:



Published in New York City at 225 West Thirty-ninth Street



THEN the wind blows, you have often seen the sails of a windmill go round. But have you ever seen a windmill with just one big sail which, instead of going round, flapped up and down? Here is one,

straight from South America.

Yankees and Europeans have been content with the rotating fan which has hernessed the wind to the pump since the darkest days of the dark ages. But not so José Albisu of Saladillo, Argentine Republic. He indate that the wind supply him with pump action

The sail of this South American conception of a windmill is a tilting vane, and is mounted at right angles to a triangular frame bolted to one end of a balanced beam. The piston-rod of the pump is also attached to this beam, which is capable of a rocking and of a rotating motion. Now for the action.

When the wind blo we it strikes the frame in which the tilting vane is mounted and swings the beam into line with the direction of the wind. The wind then seizes the vane on, let us eay, the upper face and tilts it against the

> lower limit of the frame. Immedistely the wind pressure drives the beam down until this lower side of the triangle is parallel with the horison and the face of the vane is no longer exposed to the wind. The full motion of the arm, however, extends one point further, owing to the excess momentum of the weight which balances the vane. This gives the wind a chance at the reverse. or lower, surface, and the vane is blown against the upper limit of the triangle and acts as a sail to bit the beam until this upper limit in turn takes the parallel position, the vane drops, and the beam is pressed downward again.

Meanwhile the picton-rod is worked up and down with the motion of the beam and is busily pumping water as long as there is

any wind stirring.



This pullman car goes from factory to factory and gives the workmen lessons in first aid to the injured

## First Aid Taught in a Pullman

A LARGE pullman car was run on to the side-track in the factory yard. A dozen laborers filed out of the factory and elimbed into the pullman, taking seats along the sides. Going out for their duily airing? Not yet; the pullman was the Red Cross first-aid car that is touring the United States to instruct workmen in how to prevent accidents and how to take care of each other when accidents do happen

The picture above gives you an idea of what goes on in the Red Cross car. Two volunteer workmen are called for—one to play sick and the other to render first aid as prescribed by the instructor. The lesson lasts half an hour.

It has been estimated that the Red Cross pullman has already saved bundreds of lives.

## Is Yellow Light Best?

RED, orange, yellow—are the colors from this end of the spectrum easier to look at than those from the other end? Is there anything back of the belief that a yellow light is less trying on the eyes than a bluish white light?

A recent lasue of "Transactions of the American Illuminating Engineering Society" gives an account of several experiments to help determine whether there is any truth in the yellow theory. The results of these experiments tend to uphold the belief.

First, the people experimented on were given a three-hour eye efficiency test in a room lighted by the yellow glow of a kerosene-lamp. They read type, and when their eyes grew tired and the type began to blur, the time was noted. Later the same test was held in a room clum-nated by a blash white light. The intensity of illumination was the same in both cases, but the type blurred much more rapidly when read in the room with the blue-white light.

A more recent experiment was made in which mantles were filled with yellow fluids of different tints. It was found that the warmer the tint, the greater the efficiency of the eye.

## The Radiator-Lifter

THOSE whose business involves lifting radiators, take note. And others also might just as well pay attention to this new radiator-lifter, for in these days you never know when you may be called upon to do your own little job of radiator-lifting. A radiator is a particularly awkward thing to handle, a fact which Mr. Edwin J Adamson of St. Cloud, Minn., recognized when he invented the lifter shown below

A T-head fits in between the pipes of the radiator and a clamp on the outside enables you to make it fast, so that it won't slip when it is forced to bear the weight of the radiator. There is a handle by means of which you may lift your end of the radiator and there is also an opening through which you may insert a bar, if you prefer.

The radiator shown in our illustration is a fortunate one: it has four attendants. The two men in front are



## Cutting Steel Bars with Giant Scissors

WHEN the large steel ingot comes from the mold it still bas a long way to go before it is ready to be manufactured into tools and other finished products.

bor running through the handle

It must first be rolled or forged down into bars or other sustable shapes.



With its great jows the gunt sciences easily bites in two a bar of steel six inches square. It makes no difference whether the metal is hot or cold

The bare so formed are usually too long, and so they in turn must be cut into shorter lengths.

This is done in one of two ways—by means of revolving circular saws or by a machine that cuts like a pair of scissors. To saw such sections in two takes more time than to cut them. Therefore, where the thickness of the steel section will permit it, the scissors method is often used

Our Illustration shows one of these huge scissors in use in a steel-mill. It takes two men to lift the bar which will be clipped in two like a match between the powerful jaws. Here the machine is cutting a section of cold steel about three or four inches square; but it is capable of cutting sections up to six inches square. It can penetrate with the same degree of ease either hot or cold metal

The machine is really two large castings of steel, one of which is stationary and the other movable by machinery on a pivot or arm at one end. Inserted on the edge of each of these castings, and held there by four or five bolts, are the two cutting edges proper, which are made of tool steel.

The cutting edges are made in such a way that they can readily be removed and sharpened whenever this becomes necessary.

## The Machine with a Dipper that Digs and Dumps

THERE is a small mach no that will march bravely up to a large pile of ore, dig right into it, and then fling great shovelfuls over its own head into a dump-car behind. Before very long the pile which looked so formidable will have desappeared. It takes only one man to operate the machine. He does it by means of three levers located at the side of the machine: these levers admit compressed air into three different cylinders.

When the operator pulls the first lever the body of the machine shoots forward and a dipper in front is forced into the pile of one; this is caused by the air being ad-

mitted into the lowest of the three cylinders.

When he pulls the second lever air is admitted into the middle cylinder and the dipper with its load is awang



The dipper of this machine will shovel a load of ore into the car behind; it is worked by compressed air

upward to a horizontal position. A pull on the third lever feeds air to the top cylinder and the dipper swings over completely to the dump-car behind. Its load 
emptied, the dipper goes back for more.

The body is mounted on trucks that can be adjusted to fit different tracks. Just above the place where trucks and body meet there are concentrie eircu.ar tracks on which the body can swing from side to side, thus allowing the dipper a large area to work in when in a fixed position. A gearshift lever moves the body. The concentric tracks are placed in such a manner that the dipper will always drop its load in the middle of the dump-car.

The machine has an average capacity of forty-five tons an hour. It is so adjusted that when the dipper hit; an immovable

rock it will climb over it without any damage to itself

The machine has a wheel base of nineteen and one half inches and weighs two tons.

## Don't Tear Down That Old House-Blow It Up

A quick, safe way to raze buildings

A HOUSE, dynamite, and a flame, mixed together in the proper proportions, will make a pile of debris. But what must the proportions be to insure the debris falling into one pile instead of cattering itself over the landscape? This problem was successfully so ved by men who were called on to demolish a bouse as quickly and neatly as possible.

The house was a three-story stone one, very solidly built; it was not an easy house to raze.

After dec ding to use dynamite the men working on the job figured out the exact spots at which they would have to place it. Three four-foot holes were dug along the two short sides of the house and four holes were dug along one long side. The other long side, which contained the most wood, was not

touched. The holes were loaded with dynamite and an extra charge was placed in the cellar against the chimney. The dynamite charges were connected up with An electric blasting machine. When the blaster brought down the handle of the machine, wood, stone, and dirt flew into the air -the house was blown to pieces. And when the pieces settled down to earth again they landed in one small pile. The wood was burned and the stones were hauled away, and the whole job done within a few hours. The stone walls of this house were twenty inches thick.





How to convert the substantial house pictured on the right into this nest pile of wood and stone was the problem that confronted the weekers

They looked the house over and decided that dynamite placed on three sides with an extra charge for the heavy chimney would do the trick

TIND resistance is the big factor in aviation. Not only does it retard airplanes, it also upholds them. It has to be created to make airplanes fly, and it has to be managed with great skill to make them fly well and fast. It is of importance for automobiles at racing speeds. The cars must have low seats, disk wheels without fenders, and a long conical tail in order to reduce the wind resistance. A closed car not at all atreamlined, and presenting a front of, say, 48 square feet, would create a wind resistance at 80 miles per hour of 0  $003x48x80^2 = 921$  6 pounds, to overcome which, at the 80 m.p.h., would require  $\frac{991.0 \text{ m/s}}{375} = 196.80$  homepower, in addition to the power needed for traction. At 40 m.p.h. the power required for overcoming the created wind resistance is only one eighth as

With these familiar facts in mind, many persons are inclined to apply the idea of streamlining to railway trains, and several propositions to this effect have been made. They have fallen on deaf ears. Are the railway authorities blind to their own interests? A brief examination of the conditions will show

large, or about 25 horsepower.

#### Locomotives Built Since 1905

More locomotives have been built since 1905 than in the entire previous In none of them was any effort made to reduce wind resistance. although not a few were intended for speeds of 80 m.p.h. The locomotive is built with a frontage of from 100 to 160 aguare feet, composed of numerous irregularly projecting minor areas, and there are sharp corners and flat sides on the train it has to pull, all causing wind resistance. An engine at 80 m.p.h. clips a 70-mile head-wind at the rate of 150 m.p.h., and the wind resistance at this rate, if it were realized, would consume from 1,500 to 2,500 horsepower Since the indicated horsepower of passenger locomotives ranges between the same figures, with few exceptions, nothing would be left for traction, and the actual result is that the train is slowed up at least 10 or 20 m.p.h.

The tractive effort of which locomotives in passenger service are capable has been increased since the year 1900 from 25,000 to 60,000 pounds. Average transloads have increased from 410 to 700 tons. Muximum locomotive horse-

## Is It Possible for the Railway

By cutting down wind resistance, one hundred



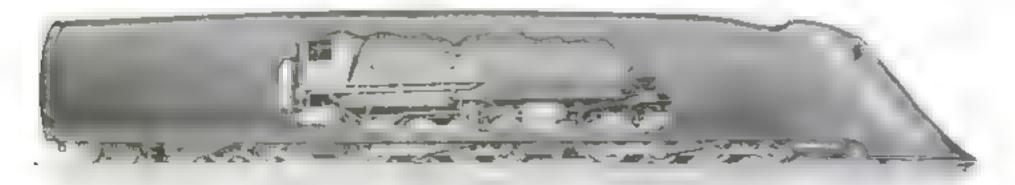
powers have gone up from 1,400 to 2,800 for passenger trains. The much higher figures for freight and pusher engines need not be mentioned, since these types are not intended for the highest speeds. Taking 2,800 indicated horsepower as the maximum for a locomotive presenting a frontage of 125 square feet, one can figure loosely on the importance of wind resistance in the fastest normal railway operation now

#### Big Features Airendy Streamlined

One square foot of area held squarely to the wind resistance consumes 4 1 horsepower at 80 m.p.h., only 1.73 horsepower at 60 m.p.h., but 27 horsepower at 150 m.p.h. These figures give the keynote in the situation. Even if the frontal area of a railway train were erected squarely, however, at the front of the locomotive, the wind resistance at 80 m.p h. would be much less than these figures indicate, owing to the elongated shape of the train. In point of fact, the largest cross-section comes at the cab, and the wind is split to a considerable extent by the cowcatcher, the buffer-bar, the high- and low-pressure cylinders, and the smokebox. When one remembers that perfect streamlining of the whole train would reduce the wind resistance at high speeds to from one fiftieth down to one hundredth part of what it should be according to the cross-sectional area, and that the train, despite its angular ties, is better streamlined in its big features than any other big thing, excepting only a drigible, an estimate of the horsepower really consumed cannot be placed higher than two horsepower to a square foot of cross-section. This makes a total of 250 horsepower at 80 m.p.h. But, on the same basis, the wind resistance at 150 m.p.h. consumes a little more than 2,000 horsepower.

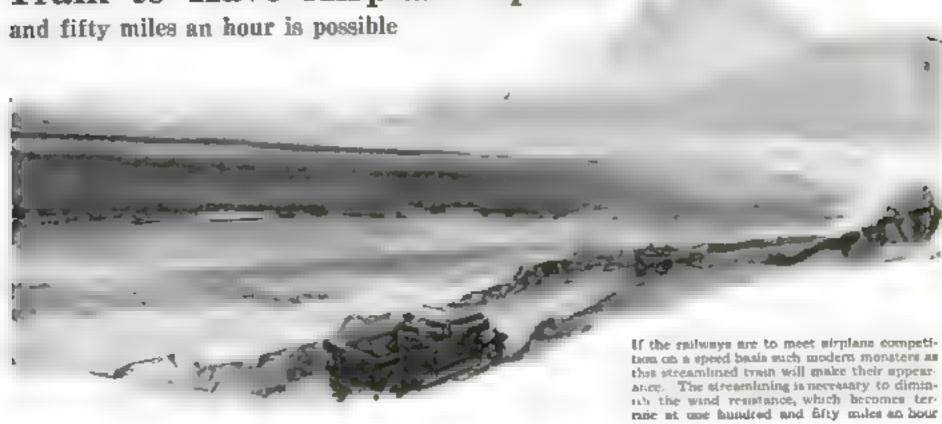
The 250 horsepower constitutes less than ten per cent of the power employed, and to save more than half of this waste, reducing it to below five per cent, would require the most radical reconstruction and reshaping of every feature in the locomotive and the train. Rallway engineers have much more obvious and plausible means at their disposal for saving five per cent of the fuel bills; and this explains their total indifference to the streamlining of railway trains. They have done a great deal in the past twenty years that virtually reduces the wind resistance factor by reducing its percentage of the

Locomotives and trains are much heavier than before, while their crosssection is very little larger. The



How a foromotive will look when railway speeds increase. Contrast its outline with that of the present type as shown in the broken away portion of the illustration

## Train to Have Airplane Speed?



average power is more than doubled. Improved and lengthened fire-due boilers, compounding, superheating, and increased boiler pressures have been the principal means employed. More than 7,000 of the 65,000 lecomotives now in use in this country burn oil, but high oil prices are stopping this development. On the whole, the efficiency is enormously increased. Head-wind storms of from 40 to 50 m p.h., which would have retarded passenger trains seriously fifteen or twenty years ago, are of no consequence with the new equipment.

#### The Dirugible Shows the Way

The matter changes completely when running speeds of from 80 to 150 m.p.h. are contemplated. A loss of 2,000 horsepower for wind resistance cannot be accepted. Either 80 m.p.h. must be taken as the natural limit for rallway speed, or something radical must be done to cut down wind resistance. It is the mammoth dirigible that shows the way. For, with much larger crom-section than that of a locomotive and with much smaller power, it makes 70 m.p.h. A big seaplane, on the other hand, with its large exposed areas and need of sustentation, consumes 1,600 horsepower for wind resistance alone at a speed only slightly higher. The railway train must do better than the sea plane in this respect. And it can be made to do better, as it is similar in shape to the fuselage alone and can have plenty of power

There are only two difficulties: To make it stay on the tracks and to make it pay. They are enormous but perhaps not insuperable. When people begin to demand airplane speeds combined with railway carrying capacity, the demand can be met for passenger, mail, parcel,

and perishable freight service operated with special locomotive and car equipment and over tracks that have all changes of grade and all curves located at the stations, where speed is reduced.

Asia, Africa, South America, and Australia will soon be bidding for new fast lines giving an opportunity for new construction of tracks and rolling stock without the immense handicap of the old construction on hand. Then it will be financially possible to reduce a wind resistance calling for 2,000 horsepower at 150 m.p.h. to many times less. The aerodynamical possibilities have already been demonstrated beyond controversy by the dirigible. The United States may jump into the lead with a transcontinental railway of this sort to beat the airplane.

The trains must be units, smooth as an eel from nose to tall. But even eels have gills. Dirigibles have their suspended cars, which break the outlines. The streamlined trains may still have the locomotive drive-wheels exposed just enough to facilitate inspection and oiling But the fronts must be remodeled. A huffer-bar will not be required. The cow-catcher will reach to the rails and will, in fact, sweep them. It may serve as a snow-plow, and may take care of straving elephants, buffaloes, and automobiles. As little air as possible should be permitted to pass under the train. The crude eand-box will be utterly discarded, being destructive of the supreme perfection of track and wheels. Headlight, smokestuck, and domes will be lined up in one covered ridge.

The bell is already a mere traditional encumbrance. An alarm of automobile pattern can take its place. A periscope is better than an outlook to give a view of track and approaches. So the cab

need be large enough only for the comfort of the engineer. The fuel should preferably be oil, and the tender can be made as high as the cab. The long fire-flue boiler could be made slightly conical (we have "conical" boilers now) or it may be tipped a few degrees forwardly.

#### How Streamlened Trains Will Look

In its outward lines the structure will resemble a big freight locomotive in reduced dimensions more than a passenger locomotive. It will have eight pairs of driving wheels in two nets, to get all the traction possible for its weight in all kinds of weather and to distribute weight and pounding over the precipitous track. It will have superheat but probably only single expansion on account of the speed wanted. The need of aprings is due solely to roughness, grades, and curves of the track. When flexible bolts take their place, as used now in the boller legs, the bodies of tender and cars can be lowered to within six inches of the rails. The wheel trucks can be dispensed with, the axles being mounted in the body with access from within; and the wheels can be removed from the outside for truing up.

The bearings will still be air-cooled. All airbrake apparatus can be enclosed in the false bottom of the cars, and may work on abeaves on the axles. The first car may be for mall and freight, the second for passengers, the third a baggage-car shaped for tailing off the streamline. The train may be made as long as the traffic justifies.

When the railway engineers, with their greater competence in all details, begin to dream and figure and design along these lines of thought, the railway train with simplene speed will not be far away.



#### When Cormorants Go Fishing for Their Masters

"CGRMGRANT a germant" very much a ke - that is, all cormorants are governmeds. The cormorant of great black ord with webbed feet, switch gh the wall and swall we all the book presentation all. Kirch Land a new atflate p it he often tamed when you have a taught to return to its master with all the fish it has enought

A strap in fastened around its throat when it goes fishing, so that it will not he alle to awal my the verticus. It meeps the fish its its flex blo throat. Yangariy stouck og, it op to them out at its mas-105 in feet

#### Has She the Longest Huir?

T is end I unthropology the right hair grows the songs as we are thortest, while wavy hair holds an intermediate position.

However that may be, Miss Ethel Payne, an English girl, bossets of having the longest hair of any woman to the British Isles,

although her

B y Pa + s

Cupyright, International Pilm



## A Balcony Scene

THE clean, neat white grain-elevator in the picture above recembles a tipey inck-in-the-box when reflected in the turbulent waters of the Musinsippi. The balcony

HERT LA	se ruli mi	the contract of	till rude å	Salarah, Tibio	Ma
-		esattely f	116-613	2 4	
4 4/4		ol the i	maige as	17 4	у.
Was a					
1	.1.	M.Ve.y	r 3	4. 1	1
English .	4 .	1 4	94		
Part a	1 2 1	s. A		W P	
r.	h 5 t				
	- 1	1 1 1	et absolu	16' %	4
00 - 0	1.10	1 5 422			

#### Beating the High Cost of Living in East Africa

WP has a tear man of his area or and the service of the arts of which are field tow in the picture. Mr. Hac-lock, an Eng shman, made his catch off the East African coast. He calls the fish a kind of sea-base. It weighed two hundred and fifty the period of the second the second of the second 4 4 7) ( nn × 2, 

#### Fold Up Your Boat and Walk

FTER all, a row-boat does not have to be made of wood. Mr. Swinburge, of England, bailt a collaga bie boat of canyus, and he is shown berewith both carrying it in his hand and rowing

It is made in four compartments which, when blown up, form a square. A piece of canvas sireiched across them acts as the bottom of the

14. 1

5 % 3 35 1

1 arms of H

91 2

a star to a fer

NOTE OF PARTY OF THE PARTY OF T





#### Smoking the Family Cigar

NOWADAYS, when the supply of tobacco is short and the price is long, on that, as someone recently said, you "can now get an excellent five-cent cigar for twenty-five cents,"—life in the Philippines has its attractions for the amoke-

We can't speak for the quality, but a glance at the picture above teaves so dought is anybody's mind as to the quantity of the eight in question. However, the young woman is not going to smake this two-banded eight all by herself. It is probably a family eight

Sometimes these huge cigars are auspended by a cord from the ceding of the living-room, so that any one passing by can snatch a puff

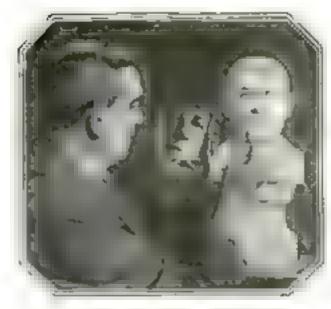
#### The Arch of Many Woods

THERE are about three thousand different kinds of wood in Carada, and they are all represented in the arch abown below. Some were gathered in the "bush," others in the archic tundras, and many more in a dozen different recuntain-ranges. The arch is located at the entrance to the exhibition grounds at Ottawa, and is really effective in spite of the many kinds and colors of the woods that make it up.

But, alas! the ticket-seller is a mercenary man who cares nothing for appearances: he has built his booth of common pine slabs and It stands

alongside of the arch.

The arch is not purely ornamental it has three turret-the observation towers from which visitors can get a general view of the exhibition grounds. There are stairs at each end of the arch, and a narrow path that extends from and to end. Thus it can be used as a bridge



#### A Toolmaker Turns Sculptor

hem, William Rutter awake one night from a deep dream of peace and vistoolmaker by trade.

Early the next morning he went to the

public library and borrowed "The Technique of Scu pture," returned home, and began to model busts with the help of a small penetrifo, some matches, and clay

Mr Rutter in shown above working on a bust of himself. Looking at the mirror and then at the hunt, you are convinced that Mr. Rutter sees himself as others see him, but, musing on present-day labor wages, we advise him to stick to too making



#### Putting the Sea in Seaplane

THE scaplane, as its name implies, is a creature of air and water it is, however, more at home in the lighter element, and often therefore comes to grief when it is forced to slight in the water in rough weather

For this reason, more and more attention is being paid to the construction of the hulls of flying-hoats. The photograph reproduced below shows one of the largest passenger-carrying semplanes over built. Her hull is of the sex-sled type.

Seg-sleds unencumbered by wings are almost unbelievably speedy—one designed for government use being credited with staty miles an hour—and they are remarkably good sea-boats. With a bull of this type the scaplane lives up to the first part of its name.

#### It Simply Got Their Goat

UP to the present time the usand of Guadasot pe has been a nort of goats' paradus. The goats had only to grass and blest and butt to their hearts' content. Then nature butted into the goats' paradise. She turned off the rain and the vegetation dried up. While the goats could still butt and blest, they could so longer grass. Now, goats feel that grasing is very necessary, and consequently life soon became unendurable

In view of these happenings, they are emigrating, under supervision, to San Diego, Cal., where they will live in a decent do-

mesticated fashion.

In the picture below we see some of them making the journey on the Mesican steamer La Pas

Coperight International Plm Service Co





## Corr gate learnth and is proved. between rows of wood blacks so that the black may expend In wa in weather w thout burg ing. Also the corrugations help to hold the pitch in place

## Wood and Cardboard Paving

\*IORRUGATED cardboard!--what's it used for? Bundies, you say That is its chief job, but it is also used in thegutter, as a spacer for wood block pavement. The corrugated cardboard is cut in strips and placed between the rows of wood blocks to allow for expansion in warm weather, and to act as a dam for the pitch. An old wood block pavement was full of waves and bumps. The blocks were taken up and a new bed of sand and coment was last; the blocks were put back in rows with a layer of eardboard between them.

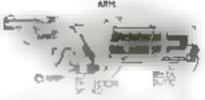
When the pitch was poured in, the corrugations dammed it up and kept it from running to the sides.

## A Gun Up Your Sleeve

ANDS up!" commands the masked train robber

The hands are still going up when there is a sharp report and the highwayman collapses in the doorway

Who fired the shot? A traveler coming from the West, When the hold-up

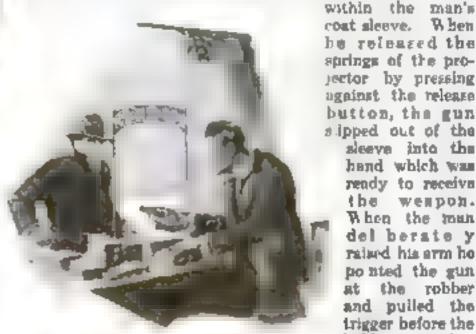


This diagram shows the simple mechantum of the gun projector which is to be strapped to the foresrm

man rave the command "Hands up!" the traveler pressed his right elbow against his hip. This released a spring. which caused a loaded revolver fastened to a clamp to with forward along the two guide-rods strapped to the forcarm. The gun and the projecting mechanism were

> coat sleeve. When be released the springs of the projector by pressing against the release button, the gun sipped out of the sleeve into the hand which was ready to receive

the weapon. When the mun del berate y raised his arm ho po nted the gun at the robber and pulled the trigger before the hold-up man became aware of his danger.



A loaded gun that springs out of your streve as your hand goes up would be mighty handy in case of an attempted hold-up

## Chopping Off Minutes and Saving Strength

the wheelbarrow. In one of the barrows the weight of the load is much pearer the supporting wheel than in the other.

This increases the leverage so that with the same effort the man can carry from 100 o 150 pounds more cost

the ill-balanced barrow

The other pictures illustrate the difference between the right and wrong kind of shovel. In the shovel with the short, curved handle only sixteen pounds of coal can be lifted. Twentyone and one half pounds can be bited

OOK at the pictures of the man with each trip than he can when using just as easily in the shovel with the lang. straight handle.

> With the short shovel and the wrong wheelbarrow one man can handle 45,000 pounds of coal in twelve hours. With the long-handled shovel and the right kind of barrow he can hundle 65,000 pounds in eight hours with less fatigue.



This man is handicupped by a poorly balanced wheelbar row Note the short handle and the location of the wheel out from under the container This man handles 65 000 pounds in eight hours with less fatigue than he could handle 45 000 pounds in twelve hours with the other wheelbarrow

Stooping low for every shavelful strains the back. The long-handled shovel saves strength and applies it to the weight of the load to be lifted

With this long handled shovel the capacity of the accop can be increased from sixteen to twenty one and a half pounds without sucreasing farigue

## A Remedy for Cold Feet

THE present generation is going to keep its toes warm when it goes skating. A toe-warmer has been invented which is a comfortable, unug-fitting toe-piece, made of soft leather. Some are made plain, and some have the natural

for left on. Sheepskin is recommended as an excellent material.

Think of the coxiness of wearing a skating-shoe with a warm, woolly toe-piece. And how comforting it would be to those chunks of ice in the tonneau that used to be your feet. On a very cold day almost anybody, anywhere, would welcome this hulf-brother to the moreasin. Of course the shoes must be larger than those ordinarily worn.



Dun't let gold feet soull your sport. Dress up your feet in mag, wholly toe warmers and this means especially you automobiliets and skaters



With this paw trees may be cut almost level with the ground, which means a conaderable enving of lumber

The Thrifty Thrift Stamp

"I'HRIFT stamps practise what they preach. You who have bought them know how they come, in page formation with cross-line perforations separating them from one another. What becomes of the small paper circles that full out when the perforations are punched? They are not thrown away, oh, no indeed. They are kept and sold by the barrelful to paper manufacturers. Such is the thrift displayed in the making of the thrift stamp.

Every day one billion three hundred and sixty-five

million holes are punched, in the United States Bureau of Printing and Engraving, and the small circles that drop out fill four barrels. The stamps are printed in sheets of four hundred, and each sheet contains ten thousand nine hundred and twenty perforations. Bureau turns out one hundred and twenty-five thousand sheets each day. Do the multiplying yourself.

Threadhare money is also salvaged. It is boiled to water and sode-ash until it is reduced to a wet pulp. then sold to paper manufacturers. In one year the bureau sold nearly four milhon pounds of wet pulp and four hundred thousand pounds of shredded money. light metal frame shaped like the frame of a Jeweler's saw. The naw is driven by a small bensens angine with which it is connected by a flexible shaft. The engine has two cylinders, is capable of developing five horsepower, and is equipped with a muffler. It is cooled by air.

extremely hard steel which will remain sharp for many

weeks under continuous use. This endless blade is sup-

ported on four ball-bearing sprocket wheels mounted in a

In view of the shortage of labor which makes itself felt

acutely in the country districts of America as well as in Europe, a saw of this description would be highly useful for farmers and owners of timber-land. Only two men are required to operate and transport saw and engine and the quantity of fuel consumed by the engine is insignificantly small. The trees may be cut so close to the ground that the stumps left after the cutting are scarcely more than an inch or two in height and do not interfere with the use of vehicles in the cleared parts of the woods.

N a single day during the recent war, two German soldiers cut down five bundred pine and fir trees of an average diam-

How did they do it? They used a saw invented in the early part of the war by A. von Westfeld, a German

Instead of having a con-

tinuous ribbon-like blade.

the saw is composed of chain

links, similar to the drive

chain of a bleyele. On their

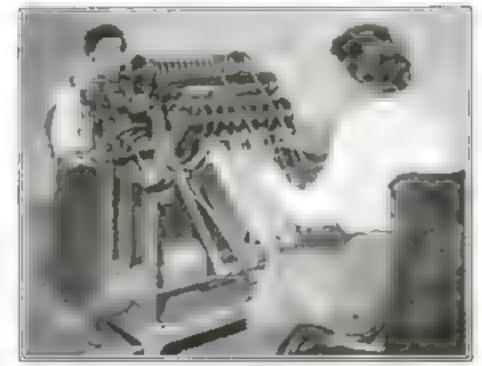
outer side the links of the

chain have cutting teeth of

eter of one foot

engineer.

This saw may also be used to advantage for the cutting of firewood, at a great saving of both time and labor.



Sheets of cigar stamps are now being run through the perforating-machine the small paper circles that drop out are kept and sold as paper stock

## What the Wind Can Do



The fricky buggy wrapped itself around a ginetree stump and stayed there but it needed the assistance of a cyclone in order to get there in the first place. The top of the tree was blown off and the barn directly behind it disappeared completely



In one minute a cyclone can do as much damage to a town as four years of bombardments. Doesn't it a wak is a some the shape of the man that passed through by by he was set houses we strong to a set houses we have a bottom to a set houses we can be



A clear that a court a court a court a court account account a court account account a court account account a court account a



This junk heap was an automobile before the cyclone hit it the sides are battered in, the stuffings coming out, two unharmed tires are sitting in the back seat, and the engine has completely disappeared. Could an actual collision do more?

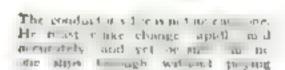


"Will you walk into my perior?" said the cyclone to the tree—and the tree walked in along with several other uninvited guests. Who can doubt but that the cyclone owns the parior now? No one else would claim it

## Luxurious Trolleys

With mirrors and cushions for motormen, clocks and handrails for passengers, are the trolleys trying to compete with automobiles?





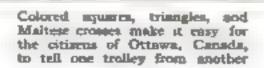


As the sampsters would see the root of the sit he igh is a soil. While his passengers as stadt on a 1 westers

the way the time is a least on me at the

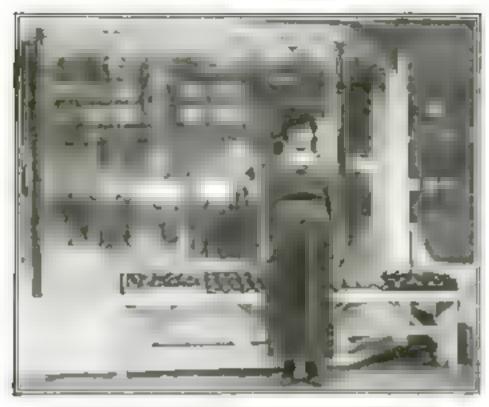
form if a leep c it ioned a satuble seat

Are street-cars trying to put automobiles out of business? Most automobiles have clocks, and now the trolley our is sporting one



antinumini ff

There are plenty of seats, yet one man persists in standing. Pethape he is trying out the new center rail that has recently been installed



When you finish looking at the lady in this picture, look at the store window behind her. Down it a sheet of water pours constantly, attracting the attention of shoppers

## Always Rain on the Window-Pane

"FITHE pipes have burst!" said one man to another as be pointed to a store window down which torrents of water were running. They rushed across to watch the exe tement, but there was no excitement. The storekeeper

acted as if nothing unusual were happening. The water conlinued to pour, but, curlous'y, it did not flood the floor of the

The deluge was planned to attract attention. Inside this window it rains all day, regardless of the weather without. A perforated water-pipe is fastened along the window's upper edge and a coment trough for catching the water is grooved along the hottom.

Through an opening at one end the water runs off into a drainpipe. The perforated pipe is connected with the pipes in the basement which furnish water throughout the building.

Put on Your Skates at Home NLMBED fingers need no longer be among your troubles at akating parties. If you adopt the invention of Nathan Sadowsky, of New York, you can walk

from your home to the pond with your skutes already

at ached.

The new device is practically an overshoe with a sole sufficiently thick to serve as a guard for the blade of the akate. The top fits the shoe, and is fastened in place by a

toe-cap and a thong at the heel. The "anle" of the overaboe is made of cork, or other light material, with a deep groove down the middle to allow the skate blade to sip in to its full depth. To allow for variation in the blades, beel and toe are slit.



If you don't mind looking like a Celestial, or as though you had club feet, you can keep your fargers warm and add a cubit to your stature at the same time

## Does the Insulator Insulate?

IF the insulator is defective, it always means a loss of electric power and, in the case of a high-power circult, great danger from short-circuiting the current. To prevent, as far as possible, such loss and danger, the insulators of high-power lines must be carefully tested before they are installed, and the tests must be repeated from time to time, especially during extremely bot weather

> lumilators are usually made of porceluin and metal. Metal expunds proportionately much more than porcelain, and in hot weather this expansion frequently breaks the porceinin

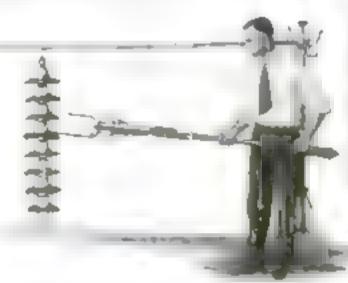
> The accompanying picture shows the method of testing in-

sulators for high-power circuits before they are put to use. After they have been put in service the insulators are tested in a like manner, but the current in the line must be shut off while testing. The long bandle of the testing

> apparatus contains several dry cells, the current of which is n series with the low-tension windings. of an autmobile induction coil

and a map switch

The high-tention windings of the induction coil are directly connected across the two tines of the testing fork and are in series with an automobile sparkplug. Whenever the fork is placed across the metal parts of adjoining insulators, one or both of which are defective, there will be a discharge across the spark-gap. There will be no discharge if the insulators are in good condition.



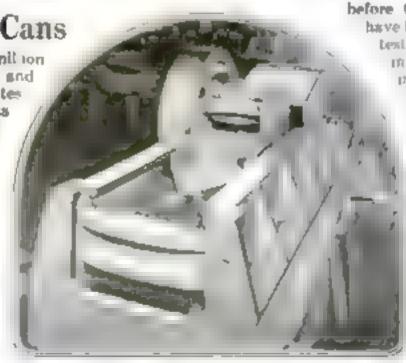
If one of the insulators is defective a discharge at the spark-gap of the resting fork will indicate it. Current is supplied from the bandle

Rejuvenating Tin Cans

PPROXIMATELY two million cans are opened, emptied, and thrown away in the United States during a year. This represents eight hundred thousand tons of material—eight thousand tons of which is pure tin. And tin is valued at about sixty cents a pound.

The machine in the pictu e is putting up a good fight against such waste. It 'akes an old tin can, chops off its head, then chops off the base, sitts it down the seam, and final y flattens it out so that it is once again in sheet form. The heads and bases are metted in an electric furnace and the tin reclaimed

The machine was invented by Thomas D. Maler of Maryland.



This machine will take an old tin can milts jows, thop off top and bottom, slit it down the seam, and flatten it out

## Don't Drop the Stove-Lid

THIS new stove-lid lifter consists of two handles with lifting hooks on the ends. The handles are clamped together near the books and, in a normal position, the two hooks become as one. These hooks are inserted into the lid and the handles are pressed together. The books then part until they hit the sides of the hole. A toothed ratchet attached to one handle near the upper end simultaneously passes through a slot in the other handle and locks it

When you press the handles of this store-lid lifter, you spread the hooks at the ends and the hid is held

fast, with no possibility of slipping

In place
To remove the lifter from the lid, move a lever that locks the blade, and the handles will spring back into their original position.

## Two All-Metal Airplanes

FRAILTY, thy name is not only woman, but airplane. An expert tells us thus: "Today's airplane is soon fit for the acrap-heap even if it is merely kept in storage. What is the reason? The airplane is a wooden structure of exaggerated size and strength, and yet of minimum weight. The wood is kept under continuous strain even while the machine is idle, and it must retain a rigidly constant shape—a most difficult thing for wood to do under extreme weather conditions."

How about making airplanes of metal? Steel, for instance, would not be greatly affected by extreme weather conditions, and it is certainly strong enough to retain a rigidly constant shape. But steel has this drawback: it is too dense to stand the motor vibration to which it would be subjected. Steel and aluminum together—that seems to be the ideal com-

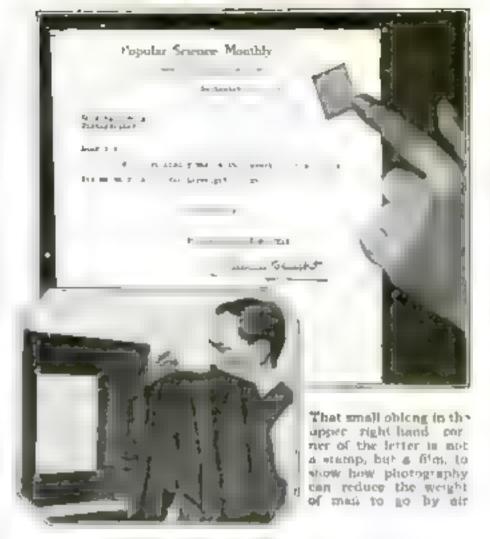
hination for airplane construction. The two airplanes shown here are built on this principle; the Bristol is an English airplane and the Brita, needless to say, is a German one.

In the Bristol biplane, except for the propeller, there is not enough wood to make a match. The strute are of hollow steel, the spare in the wings are of steel, and the more jointed ribe of aluminum. The funciage can be disascerabled into several sections for transportation. It weight no more

than wooden sirplanes. Berta, on the other hand, is a monoplane. The wings are thick, short, and are covered with corrugated alamanum abecting. They are ao strong that no outside bracing by wires was needed; power-wasting air restatance is thus eliminated, Inside the corrugated alaminum there is a complicated framework of steel and aluminum.



This English biplane is made of metal—steel and aluminum combined, the strute and spare are of steel and the more jointed ribs of aluminum the fuscinge can be disassembled into several sections for transportation.



## Feather-Weight Air Mail

Your letter will reach the other side in ever so much less time than it takes for it to travel by ship, but won't the price be prohibitive? This is the most troublesome question that comes up when mail by air across the sea is discussed. Major-General Sir Percy Cranwill Girouard has devised a

plan that will make atrahip mail cost little more than ordinary mail service. He would photograph the contents of each letter and develop it on a film an inch by three quarters of an inch in size. The film would be sent across the ocean, and would be printed, when it arrived, on a sheet of eight-byten-inch letter paper. It would be placed in an envelope, addressed, and mailed.

The film weighs just one fitteth as much as the ordinary letter, envelope, and stamp, and thus fifty film betters could be sent in

the place of one reg-

This original idea would solve the problem so far as business letters are concerned, but of course a scheme of this kind is not likely to be very popular in the case of personal letters, since they would have to be twice exposed to strange photographers and camerna



Berie is a German all metal fire proof monoplane the abort, thick wings are covered with corrugated aluminum sheeting, making it unmovementy to use bracing war.s

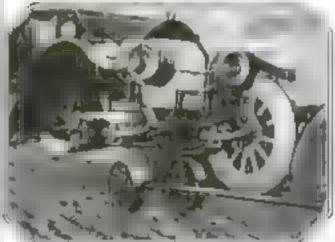
# ORWAND BOTAVALS SIDE POR UNIOF DECK UPPER DECK MAIN DICK

The very latest thing in commercial steamships is a boat built to carry automobiles and motor-trucks for distribution along the Atlantic scaboard

### An Automobile Ambulance for Injured Cars

OSSIBLY there is nothing in the way of garage equipment more necessary to the man dolng a general automobile repair business than the automon le ambulance. There is no work, in connection with the repairing of automobiles, that is so irksome as that of getting a desabled car out of a datch or off a telegraph-pole and transport ng it several miles or blocks to the repair shop, unless the man handling the job is properly equipped for that

When attached to the front axle that ambulance is clamped securely to the center of the aule, thus supporting the entire front end of the car and allowing the tongue of the ambulance to control and guide the car. When attached to the rear axle it is ordinarily applied to the brake-drum on whichever aide the injured wheel may be located. In extreme cases, however, where both rear wheels are out of commission, the ambulance can be upp led to the center by lashing it to the middle of the differential housing or, preferably, to a bar lashed across under the rear system. It will pay for itself in its first job



The automobile amountaine employ the paragemen to save money by handling his " tow-in " jobs with only one man

## This Ship Was Built to Carry Automobiles

have been shipped by boat across the Great Lakes to Buffelo, and then driven overland to their destination in New York or New England. Most of such shipments were made under difficulties, because the vehicles were carried on regular passenger vessels. Now, however, a navigation company of Detroit has designed a boat especially for the service, so that the transporting can be done on a large scale. The vessel, designed by Mr. Frank E. Kirby, is shown in the accompanying broken-

The ship will carry only the officers and crew, and will be operated as the , fluctuating production of the two automobile cities direct.

away illustrations.

This automobile ship will be three hundred feet long and seventy-five feet beam, and will be capable of carrying between three hundred and seventy-

Two elevators located amidships permit even the largest motor-trucks to be taken aboard and stored away in the hold

PHOUSANDS of automobiles, and even motor-trucks, five and four hundred motor-cars and trucks. Most of these will be carried under cover on the two principal decks, but some may be loaded on the upper deck on the outside.

The ship will have several new features never before included in an ordinary passenger-carrying steamer. These include extra large side hatches wide enough and high enough to load the biggest motor-truck with its body; elevators for transferring the vebicks from the main-deck to the upper decks; and turntables on the two principal decks to make the handling

The two elevators are located on the center line of the ship directly in a line with each of the two large side hatches. The vehicles will be run on to the boat under their own power, and will not be moved by manual labor, except when necessary to place them in position on the ship.

#### Let Your Thumb Help to Identify Your Car

VERY reader is familiar with the finger-print method of establishing the identity of principles. a establishing the identity of criminals and ferreting out clues to obscure crimes. The newest use for this science, which dates back to the days of the succept mandarins of China, who used their thumb-prints as royal seals over life and death, is to identify stolen cars and protect owners from such thefts. Also the prospective purchaser of a used machine can assure himself

that the person offering the car for sale is the rightful owner asking him to show an identification card bearing a duplicate of the thumb-print.

A label, with a white field for the print, is transferred on to the cowl or curved strip between the hood and wind-This transshield. ferring is done with a waterproof solution which affixed the label permanently to the varnish. A roll impression of the com-



Here is a take and sure way of determining whether a car is operated. or owned by the rightful person

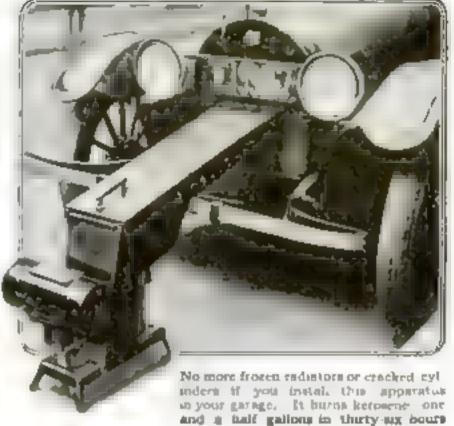
plets pattern of the ridge formations of the thumb is then made on the white field of the label, with special ink, which burns through the varnish finish.

#### A Tractor Turns Locomotive

PRODUCE dealer was pecasionally a need of power at short notice for hauling freight-cars from' the siding pear his warehouse. It was his custom to order six horses from a livery stuble, but this was expensive

He asked a tractor sale man to help him out, but warned him that one tractor had tried and failed

The salesman hitched his trainer to a loaded freight-car with a total weight of 58,340 pounds, which was moved ensily. It then hauled a train of freight-cars, three empty and one loaded, the weight being increased to 170,000 pounds



#### It Keeps Air from Freezing

FOR the car owner, the time lost in attempting to start a cold engine when the gasoline will not vaporbe readily is exasperating; but for the motor-truck owner or draver, it is even more than that, since it prevents the truck leaving the garage on time for its day's work.

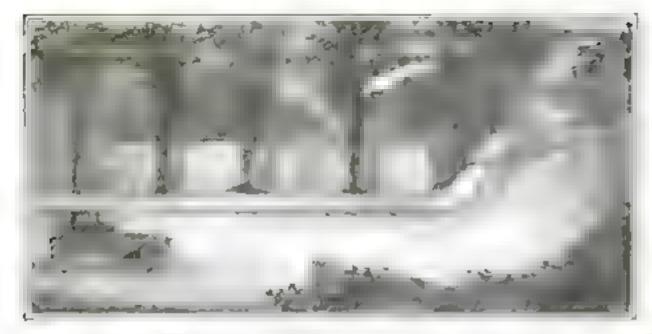
Troubles of this nature may be overcome by the combined car or truck and garage heater shown above. The apparatus consists simply of a kerosene burner with a special flue which is placed with its open end close up to the vehicle radiator. The fuel is burnt inside of the flue base and the best passes through the radiator.



This tractor pulled four hig freight-curs weighing 170,000 pounds, and didn't besitate about it either. The train was polled from a dead stop with all cars coupled

T used to be common for motorists to open their muffler cut-outs instead of blowing their borns. While this is unlawful, cut-outs may be used in testing the engine-

One motor-testing valve designed for this purpose is shown above. It is made of cast iron and is placed somewhere in the exhaust line ahead of the muffler. The valve consists of a cylindrical barrel with a bellmouthed outlet at the bottom A segmental valve, operated by a pedal against the compression of two coil springs outside of the barrel, is moved to open the bell-mouthed outlet when the sound of the exhaust gases is to be heard.



Just an oblong piece of metal set in the road-bed, but it sounds a warning toot as the car passing over it approaches the curve just aboud

#### A Voice from the Roadway

"SOUND your horn!" "Dangerous curve ahead!" The roads are well fortified with these bright red warnings. But you can't see signs by the roadside at night, and you surely don't want to toot your horn continually, waking sleepers in the houses you pass. What then?

The solution lies in the unpretentious oblong piece of metallying in the road in the picture above. As your car passes over It a horn a few feet in front of you automatically toots loud and long, letting the people around the curve know that you are

The device is not unlike the light signal system used in the New York subways and that are operated automatically by the trains

You will notice two treads running lengthwise. As your car passes over the one on the left it will be depressed and an arm extending downward from it will hit a ratchet wheel. This wheel then rotates and carries with it a larger wheel attached to its shaft

Contacts on the large wheel will hit against electric brushes as it rotates. Wires from the brushes lead to the horn and its motor When the circuit is thus closed the norn will toot.

But why have this revolving wheel instead of ordinary metal contacts? Because if your automobile is going at the usual rate of twenty miles an hour the tread will be depressed for only about one hundredth part of a second much too short a time for even starting the motor in the horn. The revolving wheel tends to prolong the contact.

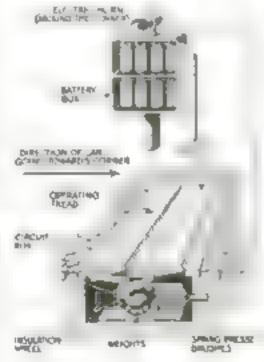
And now for the trend on the right side. This prevents the horn from tooting unnecessarily when a

car approaches from the opposite direction where it has already

passed the danger.

The right tread likewise has an arm attached to it. But this arm is fixed at an angle so that it almost touches the arm of the left trend. Then, when the right trend is depressed, the right arm swings into the left one and throws it clear of the ratchet wheel. There is no rotation and no consequent

The device was invented by Charles E. Lyman, of Asheville, N. C., and the first one was installed on "Dead Man's Curve" in Buncombe county near the building of a casket company!



As the operating tread is deprened, a contact is made through a revolving wheel and a born on a post a few yards ahead will boot A Betrousered Lady

CARE nothing for style: I can wear the suit I have on indefinitely," said Miss Fanny Harley just before she stepped into a taxicab. That, presumably, is why she wears trousers instead of akurta,

We will admit that she isn't stylish. but can she wear her costume indefinitely? It's made of white cloth trimmed with white fur, and even if she travels around in taxicaha her costume will get dirty within a very definite period

Mass Harley came from Arisona to New York to see the town and to gather material for magazine stories.

> She is convinced that women's success in the business world is threatened by their conventional, (ashionable clothing. Undoubtedly, she would prefer to see our stenographers dressed in white trousers and white fur-trimmed jackets We gravely doubt that this would add to their efficiency.

> > White trouvers and a fur trimmed jacket are the simplest clothes. mys the wearer we don't agree with her

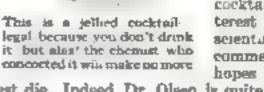
#### Within the Law

THE bone-dry amendment furbide alcoholic drinks, but says nothing whatever about solide. Is this an oversight?

Whether that is the case or not, jellled alcoholica enten with a spoon are perfectly legal. And so we have the solid cocktail shown in the picture below. The delectable chunk

was concocted by Dr. John Olsen, a Brooklyn chemist, and was served at the annual dinner of the Alumpi of the Polytechnic Institute, and the Alumni all joyously agreed that it was well worth eating. Hut, alas, we must state that Dr

> Olsen has refused to make public his formula, and will not go into the cocktail bunness. His interest in it was purely scientific and not at all commercial, and



hopes for tasting one must die. Indeed, Dr Olsen is quite surprised and perturbed at everybody's interest in his cocktail,



Probably every American soldier in France had a chance to observe the making of eou de ese (water of life), the national French drink. The French prize it to the degree that their highly descriptive title indicates, and make it at nearly every farm-house.

#### Eau de Vie

Eas de eie is a brandy, the raw material being the grape-skins left after the wine has been pressed from the grapes in the fall of the year. It is mostly an economical Franchman's plan for getting still more good from his grapes. The old sterm and other residue from wine-making are piled in cellars, and allowed slowly to ferment, until winter-time and the advent of the traveling still. This traveling still looks like a merry-go-round angine in this country, but it has two huge copper re-

torts back of its boller wherein the grape-stema and skins are given a thorough steeping under steam-pressure. The vapors resulting at a late stage in the process are condensed, and this is the cas de ric.

Instead of calling the stuff "water of life," Americans in France termed it " white mule"-"white" because of ita water-like clearness and "mule" because of its prodiglous "kick." Few there were who could ride the white male with success, or who cared much to try it after seeing its effects. But the old village fathers with their leather-kned interlors would gather around the stills, lips smacking and little tin cups clinking—one of the few times in the year when they thoroughly en, ayed themselves.

East do rie, poured out on a tile floor and ignited with a match, will burn like alcohol under a chaling-dish. It is no wonder that white mule throws the ordinary rider.

So much for the process of distilling from fruit. When the distiller uses grain as the raw material, the kernels of barley or rye, or whatever is used, are allowed to sprout, just as was the case in beer-making. Then this grain is mashed up with water, and the whole allowed to ferment while standing in a suitable warm place. The liquid may be separated from the solid in the fermented mass, and the two run through the still separately, or both may be boiled in the apparatus together.

#### Whiskey at Last

At any rate, the liquid coming from the worm is that which the operator desires—whickey, in this case, instead of brandy, as was obtained when fruit served as the raw material. Russian rodks follows the same general process, the pulgue of the Mexicans, the sake of

"Oh, boy! Dat shush am pow'ful stuff." 'Restus has been reading in the paper what may be done with corn mash, tea-kettles, and such. One cupful, and 'Rastus already sees wildcuts. Says he "I'm gwane arrive away from here! Wowie, Whotsh!" Est 'Rastus

the Japanese, and the native liquous of many other countries.

The art of distilling is very old. The modern gentleman with a thirst, who hits upon the idea of appeasing it by little operations with a still off in a dark corner somewhere, has developed no new idea. If is great-g

It is even recorded that the Chinese, many hundreds of years before the Christian era, made something they called ensichoo, which they drank with great gusto. The natives of India, Egypt, and other Eastern countries were more than passing familiar with alcoholic liquous four thousand years

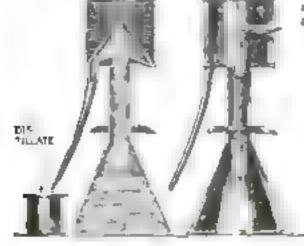
ago, and used to get drunk now and again—mostly again—whenever the spirit moved them.

So the modern investigator has plenty of precedent, such as it is. The only difficulty is that these times "ain't" like those of old. The average bleary-eyed person will tell you with much andness that they "ain't."

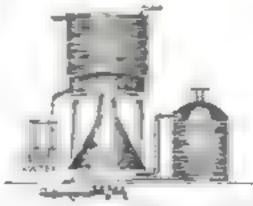
Naturally, the reason they aren't is the law. Sad to relate, the law steps in and eave no. It is not at all bashful, either, in the way it says it.

First, take this law—and it's from a whole bookful that the Bureau of Internal Revenue operates under:

Where any marshal, or deputy marshal, of the United States, within the district for which he shall be appointed, shall find any person, or persons, in the act of operating an littely distillery, it shall be lawful for such marshal or deputy marshal to arrest such person, or persons, and to take him or thron forthwith before a judicial officer. This judicial officer may reside in the county of arrest, or, if there is none there. the one pearest this county musy met.



For "distilling water and other liquids," claimed William P Swartz, of Telluride. Colo., in 1891 Its ancestors, two funnels, a tomato-can



George W Crispell, of Albany, N Y., 1917, had the needs of garage storage batteries in mind, he says, when he invented this water still



Stovepipes, tea-kettles, and syrup pails were evidently all on Emma Jester's mind (Pueblo, Colo., 1902) when she thought this up

In such a court, the law goes on to say (in effect), the offending persons may be committed to jail to await trial, allowed to go out on bail, or otherwise dealt with, as the particular case may demand

#### That "Regutered Dutillery" Sign

Man's days are few and full of trouble when he starts to operate an illicit still that you easily gather. But how much of a still do you have to be the operator of before you qualify as a distiller? If a man ran just a "teeny little bit of a still," you say, he wouldn't come within the meaning of the law, would he? Ab, yee, but the dryn have covered that. Read this:

Every person who produces distilled apirits, or who brews or makes much, worth or wash, fit for distillation or the production of spirits, or who, by any process of evaporation, separates alcoholic spirit from any fermented substance—or who, making or keeping mash, wort, or wash, has also in his possession a still, shall be regarded as a distiller

Would not this last section get you broadly and comprehensively if you

tried experimenting with stills at all? It would.

Then, as if this foregoing were not enough, consider the following.

Every person engaged in class and or rectifying spirits, and a every whosesale liquor-denser, shall place, and keep complemently on the outside of the place of such business, a sign, exhibiting in plans and legible letters, not less than three inches high, painted in oil colors or gilded, and of proper and proportionate width, the name of

firm of the distiller, rectifier, or wholesale liquor-dealer, with the words.

REGISTERED DISTRICERY
RECTIFIER OF SPIRITS
WHOLESALE LIQUOR DEALER

as the case may be.

Every person who violates the foregoing provision by negligence or refusal, or otherwise, shall pay a penalty of fire headred dedors.

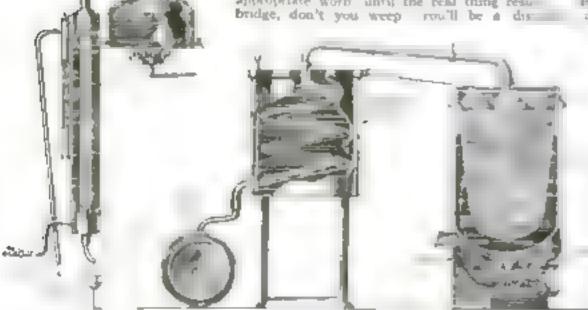
You hadn't thought of this little matter of placing a "Registered Distrilery" sign on your house in case you operated a still, had you? And in case you should put up such a sign without duly registering and paying the proper fees and taxes, listen to what happens to you:

Every person who illegally puts up, or keeps up, the sign required in the foregoing section—or any sign whatever—indicating that he may lawfully earry on the business of distiller, rectifier, or wholesale liquor-dealer, shall forfeit and pay the sum of one thousand dollars, and shall be imprisoned not less thus one manth nor more than six wanths.

Trouble awaits you if you merely go over and have a look-in on the still friend Jones is operating. Listen:



I Gilchrist, of Pittsburgh. Pa., thought up this or Pv idea in 1910. He would get alcohol out of old barrels by warrantig up their wet interior with an electric heater then cooling down the vapors produced in an appropriate work until the real thing result. He has round bridge, don't you weep rould be a discuss and we sleep."



Russell H. McMillen considered this a good idea in 1912

George Lacray, who was born in Hungary, a resident of New York, did this one in 1910. It is built for quick action and great quantities at a time. Would Hungarian goulash do for the mash?

Every person who works in any distillery, rectifying establishment, or wholesale liquor store, on which no sign is placed or kept as herembelore provided-and every person who knowingly receives at, carries, or conveys any distilled spirits to or from any such distillery, rectifying astablishment, or store -or who knowingly carries and delivers any grain, molasses, or other raw materia. to any distillery on which such a sign is not placed and kept, shall forfeit oil horses, carts, drays, seagung, or other vehicles or animals. used in carrying or conveying such property aforesaid, and shall be fined not less than fire hundred dollars nor more than fire thoueand dollars, or be impresented not less than six months nor more than three years.

#### What's the Moral ?

Wowie! The moral is, don't be caught around anybody's illicit distillery. If you haven't any homes, caris, drays, wagons, or wheelbarrows that you happen to be using for the furthering of the business, they are likely to take your flivver if it happens to be standing around, or anything else that looks full of possibilities. Who knows? And on top of that a fine and a possible so-journ in the local "hoosgow"

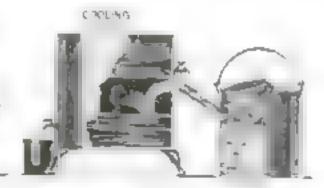
Now that the national prohibition law is in imminent effect, there is no possibility of paying whatever dues are

necessary, and getting permission to operate the still, having put up the sign; so, whichever way you look at it, it seems as if they have you coming and going

It is even unlawful to have the preces of a still in your possession. The net effect of all the new probablion laws is simply to add to, and make more restrictive than ever, the legislation and rules and regulations that already existed.

At present you may not have even a water still of any size at all, for the production of, say, distilled water for your sutomobile batteries, unless you register it and the authorities are satisfied that it's distilled water you're going to

make. And our revered Uncle Samuel in most suspicious about said stills at the immediate moment.



Simple apparatus suffices in Arizona. Mesars. Warren and Healy of Fort Thomas, 1902, asserted that this was used for water only



The gentleman tests out a mountain still in the government a Washington laboratory "Aha," says he, " 'tu the real stuff'

Now, what is it that puts the teeth in all of the foregoing laws? Who are the gobana who'll get you if you don't watch out?

There are enough of them. Besides all the United States marshals mentioned in the foregoing, and all the city, county, and state officials you can think of yourselves who might have hand in it, there are also the doughty inspectors of the Department of Internal Revenue in Washington. These gentlemen are equipped with noses that can detect the odor of CtH4OH from afor.

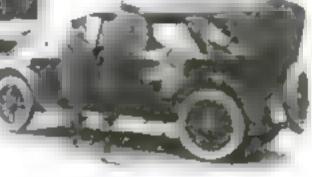
More than that, they are thoroughly on to the ways of amateur alcohol producers. He has to be a good man indeed who can get by them for long.

#### The Chemical Goblins

Back of them, and to make the evidence they obtain an exact and known quantity instead of a murky and dubious fluid of uncertain antecedents, as it usually is when found, there is a large chemical laboratory in operation on the top floor of the Treasury Building in Washington.

The experts who are employed in this chemical laboratory can analyze almost anything. Whether a concoction has alcohol in it, in the first place; if so, how much; whether there are any other narcotics in it besides alcohol; what they are, and in what degree these are some of the points they can determine about a liquid under suspicion.

Glass retorts and stills of one kind and another fill long racks down the center of the laboratory rooms. Reagent bottles stock the shelves, there is a steaming, foaming test of mysterious Scenes are the have been common the last six months. This one square a my the mat he twen We happen and Barb taire. But age a him been common, had been getting away with it. The gentlemen are mamanner of speaking.—"purched"



character going on at each of the

Men and women investigators, longaproved and with a detached, absorbed look on their faces, watch the steaming retorts—frequently pausing to withdraw some of the liquid and shake it up in test-tubes with reagents.

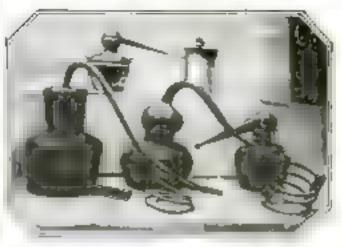
#### Surprising the Moonshiner

Then takes place a characteristic change in color, a precipitate is formed, or other activity occurs that the keen eye of the chemist can detect, and the inmost secrets of the liquid are revealed.

Other tests, besides those with reagents, are made. And so it is that sooner or later all the unknowns in the suspected liquid give themselves away.

Many a moonshiner has had his product subjected to more kinds of analysis and acrutiny than he ever dreamed men knew anything at all about before. Frequently he has gone behind stone walls for a long term because of the ability the testers have developed in ferreting out things that he had supposed were carefully esmouflaged and hidden.

Many a patent medicine has come



A collection of local talent stills Internal Revenue agents have gathered from one place and another over the country

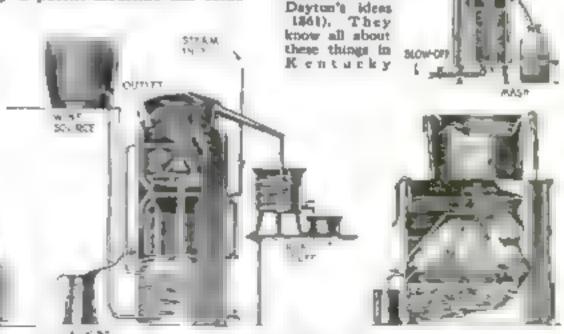
to grief at the hands of the Internal Revenue Bureau, many a hair tonic, a vanilla or lemon extract, many an opium product, and all other dubious concoctions the minds of men can think up to get around the law, and the public opinion that has made the law.

What then, were, has become of your dream of operating a still in the house somewhere, and so getting around the constitutional amendments and other things the drys have recently put over on you?

Gone it is, weth, gone for good. Touch not, handle not, have nothing to do with stills—not in these days. If you do, there's likely to be everything from the local W. C. T. U. to one thousand six hundred and seventy-lour United States marshals and Internal Revenue agents, camping on your trail.

#### Not a Chance

So, with the orchestra playing soft, soft music, turn back through these pages, look for the last time at all the pretty stills, and—forget stills; forget them for good. It's all they'll let you do.



Another of H G.

R G. Davton of Maysville. Ry 1856, fronkly avowed this was no " alcohol still." It converts poor stuff into real stuff

James T Van Ausdal, of Independence, Kan, made distilled water with this (1903

"Boller-mash-it" is James Campbell's simple recipe for allaying the thirst of dry times. He had this happy thought in Rockingham, Va., as long ago as 1870

# An airplane propeller in built up of layers of carefully selected wood arranged fanwise and glued together. From five to right slabs of wood are thus glued together. The density of the wood, the species of tree from which it was cut, and its moisture content must all be taken into consideration by the propeller-maker

#### Men's Lives Depend Those Who Make the

The brains of the scientist, and the ingenuity of the in producing the propeller

After the layers of wood have been glued together they are placed in a glue prew." The glue is applied hot. The properer or rather the layers of glued wood out of which it is to be fashioned, is held to the glue-press for a period of twenty-four hours.

After the glued layers of wood come from the press they are roughed out." The corners are usually removed by a bandsow. Then comes the shaping of the bisdes. This is still a hand operation in many factories, but during the were machines were introduced, lake the one that is shown in the lower picture on the right, to speed up the work

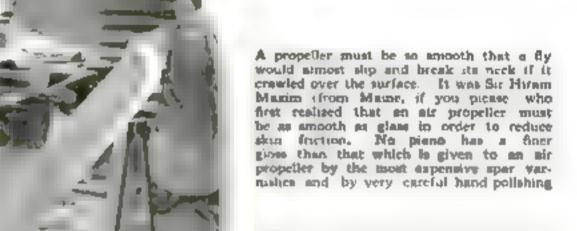
Nearly every propeller factory has a machine like this a form of pantograph. Such machines have long been used to make duplicates of statues. In the center of the machine here shown is the propeller to be copied. A tracing tool guided by the operator travels over the surface of the propeller Cutting tools remove from the reproductions cross wood to just the depth indicated by the tracer on the master propeller. The tracer feels, as it were, the surface of the master propeller and communicates the results of its feeling to the other tools.

## Upon the Skill of Airplane Propeller

the art of the wood-carver, mechanic—all are combined that drives the airplane

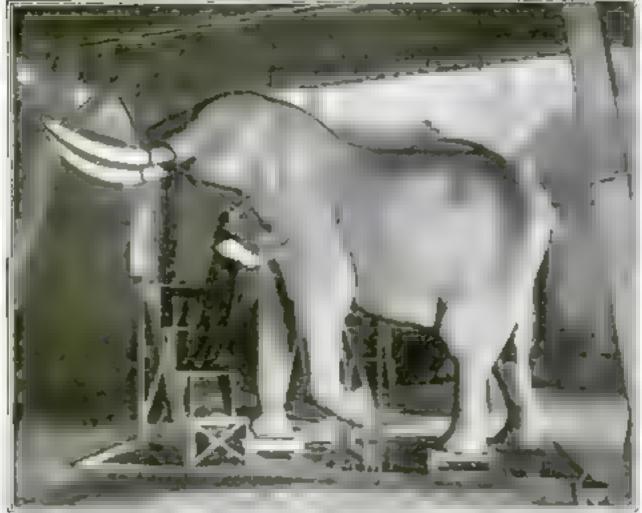


A propeller's efficiency depends partly on state ahape—a shape that has been carefully determined by mathematical calculation and by experiments in a wind-tunnel. The man in this picture is minutely measuring the surface of a propeller in order to accurately abaped or not. An autonomical iens is about the only other object we know of that depends so markedly on shape for its efficiency.



And now comes the most delicate operation of all—balancing the propeller. A propeller whirls around at the rate of about fourtees hundred revolutions a minute in the sir. If it is unbalanced the strains to which it is subjected will tear it apart. The finished propeller is mounted on an axis that turns in nearly frictionless bearings. The blades must believe in any horizontal and vertical position, which means that the center of gravity must be in the exact center. If the propeller is not believed in all positions a little wood is subbed off here and there. Sometimes the touch of a vertical brush is enough to correct the faintest perceptible arrors

This picture communizes the making of an air propeller. At the bottom, I shows the five sayers with which the propeller maker starts I shows the five sayers gived together as they come from the give press, in 3 the excess give has been scraped off in 4 toughing out has been started as indicated by the appearance of the hub in 5 roughing out is fin shed 6 shows the propeller after carving. The process here shown is that developed by the Porest Products Laboratory



By souriery of the American Museum of Natural History

Getting an elephant ready to have his akin tried on. His body is first modeled in clay with scientific accuracy

#### He Stuck to One Idea

CARL E. Akeley took up taxidermy as a career when he was a small boy in Rochester, N. Y. His first position was with Ward's Natural Science Establishment at the princely salary of \$3.50 a week. Today he is known as the man who lifted taxidermy out of the upholatery trade and developed it into an art. He was the first to approach it from the standpoint of a sculptor.

Every one of his animals is first modeled in clay, with the muscles, tendons, and bones carefully reproduced, so that the skin, as in the case of the living animal, is drawn down over a beautifully modeled body.

#### A Truck that Lifts Barrels

A REAL labor- and money-saving device for moving barrels in warehouses or at freight stations is a high-wheeled hand truck which picks up the barrel and sets it down again, with very little help from the workman.

In operation, the apparatus is set up vertically alongside of the barrel to be moved, as shown in the illustration. A bail pivoted near the handles of the truck is then slipped over the top of the barrel to hold it steady. The barrel is released at the end of its journey by standing the truck vertically and swinging back the bail. The latter is provided with slotted end members working over bolts in the wooden side members of the truck, so that the bail may be adjusted to fit any barrel.

By the use of the apparatus, one man can truck more quickly and easily than two men with the old-style truck. Besides, with the new type of truck the load is on the truck and not on the man. The machine has still another advantage in that it eliminates the necessity for rolling heavy barrels, with the consequent rapid wear of the floor.



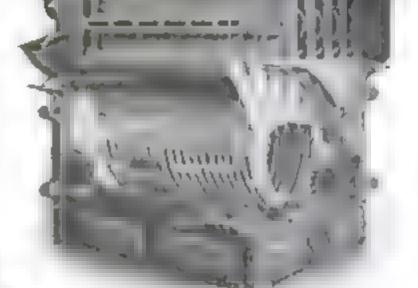
With this truck the workman can pick up a harrel without bending his back

#### Greater Efficiency from the Heating Boiler

A NEW heating boiler which presents many interesting and unusual features is of the sectional type and made entirely of cast-iron. The picture below shows the compactness of its design. It is provided with water grates which offer a large heating surface.

Air for combustion is taken in at the top of the furnace, passes downward through the fire and the water grate, and becomes thoroughly mixed with the gases generated by the fuel in the right proportion for bringing about the most nearly complete combustion. The manufacturers claum that the supply of air can be so regulated as to make the fire practically smokeless.

Either hard or soft coal may be burned in the heater. The feed can be regulated to suit the requirements of the fire. The magazines are large enough to hold fuel for from twelve to twenty hours.



This self-feeding water heater is unusually compart and embodies in the arrangement of its furnace many features that increase efficiency

#### How to Keep Cider

PERHAPS the coming of the great thirst inspired the United States Department of Agriculture to take up the matter of cider in a serious way. It has found a way to keep cider sweet indefinitely

First, the fresh apple juice must be frozen; then the mass in crushed and whirled about rapidly to separate the frozen water from the mother fiquor containing the solid matter of the apple juice. Five gallons of cider yield one gallon of a sirup-like concentrate. When you want to drink, all you have to do is to add water.

## Why Laundering Kills Clothes

A bit of science applied each Monday will add weeks to the life of your linen

By L Newton Kugeimass, Professor of Chemistry, Howard College

The business of the laundress is to remove it. The business of the laundress is to remove it. The business of the chemist is to tell her how to do it. The life of clothes may be prolonged twenty-five per cent by scientific laundering.

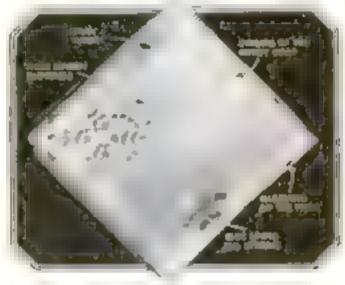
The laundering process is started with soaking to loosen the dirt and save rubbing and thereby the goods, time, and energy. The great mistake made is to begin soaking with hot water. This congulates the albuminous matter and starch, making them stick on the cloth-

ing with resultant blotches. Start with a cold-water bath, for cold water dissolves the starch and albuminous matter and gets rid of them for

good.

The kind of water used should not be a matter of indifference. Woolens galore have been ruined by washing them in naturally hard water. The sticky soap settles in the porm of the wool fiber and materially reduces its wearing qualities. For safety and efficiency prepare the water before using it for washing. Add a minimum of ammonia, borax, soda-sah, or washing soda, anough to precipitate the objectionable minerals. Stir, let the water settle, and then allow the clear water to flow into the washing-tub.

With the water prepared, the next step is the actual washing operation, which invilves combined mechanical agitation and cleansing action of soap. To get maximum service from soap we must know how it works. Soap first dissolved in the water reacts chemically, giving a mild alkaline medium. This medium prepares the way. The rest of the soap is very fittely divided into microscopic particles, all evenly distributed throughout the whole solution all the water is soapy. Each soap particle is a worker—a dirt capture! The more finely divided the particles and the greater the number,



Hard water is very had for the clothes: ammonia or washing sods should always be added your handkerchief is likely to suffer from all the ailments above above if you don't soften hard water



Her coupside are cloth enters, her bluing overused, the starch is full of germs, and your clothes are pixed together with runny other dirty clothes. Do you wonder that they don't last long?

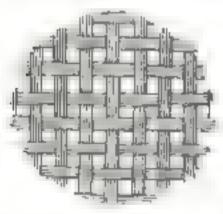
the more efficient the cleaning. The best condition is attained by slightly increasing the alkalinity with a mild alkali-soda. These durt-fighters work best in a moderately alkaline field. Since dirt is held in soiled goods by gresse, soap cleans in two operations. It first removes the grease from the materials by forming an emulsion with it. The dirt without any grease support on the clothes is now pulled in (absorbed) by the fighting soap particles. Every soap particle earries a dirt-load on its back and keeps the grease in emulsion

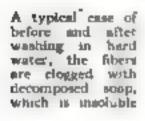
Many a laundress adds caustic sods to the soap solution. This gives an excessive alkalinity and ruins the strength, color, appearance, and wear of the clothing. Then, too, she does not invariably choose the best cleaning soap. It is "neutral soap," without free caustic, without fillers of water-glass, rosin, or peroxides, adulterations that loosen, weaken, and color the texture of the fiber. Neutral soap and a mild alkati together give the most efficient washing medium. The deady policy of leaving the clothes overnight in the dirty soap bath "rots" them.

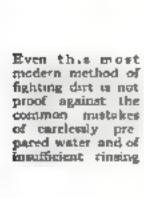
Using raw bleaching powder means more harmful effects on the clother than hard water and caustic soda combined. Treat the bleaching powder with soda in a separate vessel. The sodium replaces the calcium, giving sodium hypochlorite, the bleach liquor, and precipitated chalk settles to the bottom and is rejected. The sodium hypochlorite is acted upon by the water, giving oxygen, countic soda, and energy

To bleach with little injury, use the least sode in making up the bleach liquor, so as not to have large alkalinity, keep the materials in the bleach a minimum length of time, heat the bleach bath gradually to prevent too rapid giving off of the oxygen, and ringe thoroughly, else the bleach liquor will "rot" the fabrics.

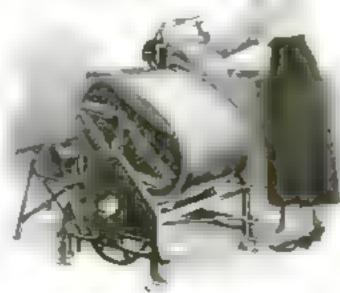
Rinsing should be thorough after each operation. Insufficient rinsing after the first suds decreases the soap efficiency in the second suds; after the bleach, ruins the clothes; before bluing, leaves the alkalimity to cause uneven setting of the blue; and also leaves the alkalimity to convert the starch into yellow decomposition products during ironing.











#### One Way of Hiding the Evidence

OES an automobile ever have five wheels? Thus in not a joke but a sensible question, which is answered In the picture below. The car shown there certainly has five wheels, one at each corner and one in a most unexpected part of the car under the hood.

It needs that fifth wheel because it has no engine of its own geared to the rear axle, and must therefore rely on a separate motor wheel

for its motion

You surely have seen bicycles propelled by these rooter wheels, and perhaps you have seen small cars pushed along by a motor wheel behind. But the idea of concealing the wheel under the hood is an entirely new and rather clever DOM:

In fact, the hood hides most of the evidence that the car is not self-sufficient.



#### A Ship-Shape Dining-Room

SHIP on the rocks usually means tragedy, but not so the ship abown here. It was built on the rock by a restaurateur, and its deck in a dining-room. To board it you cross a regular gang-plank. If you would like to dine at sea but are afraid of seasickness, you will find this ship always calm, regardless of what the sea below is doing. That sea, by the way, is the Mediterranean,



and the ship is located at Nice

## braids and its body is a continuation of its lega, with the braids lef-

Thu straw doll plays while he dances: he holds in his hands a small accordion made of paper.

An Agile Man of Straw

open. Just above the place

where the arms join the

body, a cord is wound ground and tied. That is

are painted in their proper

places, and a bat sits on top

of all You can twist his

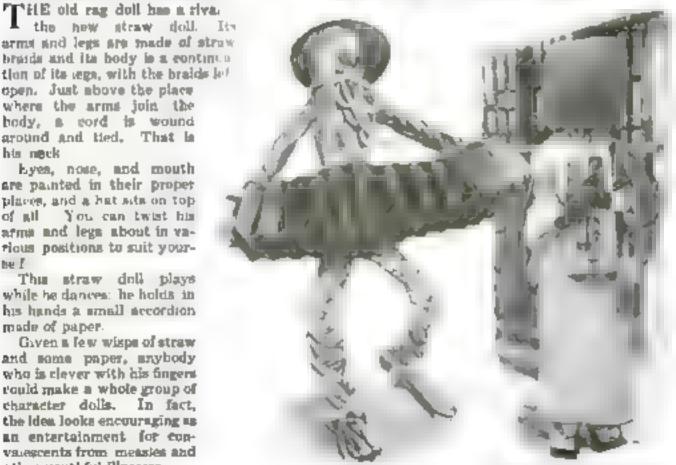
arms and legs about in va-

rious positions to suit your-

Lyes, note, and mouth

hta neck

Given a few wispe of straw and some paper, enybody who is clever with his fingers rould make a whole group of character dolls. In fact, the idea looks encouraging as an entertainment for convalegrents from measies and other youthful illusions.



Coppyright, Kes stone Photo News

#### Now Here Is a Real American Team

TO most of us the buffa.o. is a wild and wootly animal caged up in the soo and enming originally from the wild and woolly West A tame and gentle buffago is a thing quite outside of our experience.

And yet, they have been tarced have even been used instead of borses to draw wagons in some ports of the West

In the picture below you see a buffalo team hitched up to a buggy, ready to take their master out for his morning ride. It is his custom to drive the team daily to the village to get the mall and do the marketing.

The villagers are used to seeing the huffaloss trot up -yea, they do trot, after a fushion—and stand outside a shop

In days gone by buffalo leams were commonly used, but today, since buffaloes are very scarce, a team of them is very seldom seen.

#### Blindfolded Musicians

THY does this Japanese street player hide his bead while he plays? Is it due to excessive bashfu ness? The backet must be most unit cuts off the comfortable. air supply almost entirely, and yet it is a wind instrument trus print is playing!

The name of this musical instrament, which is very ancient, is shakupachi. It is somewhat like a flute, but it is much more cafficult to coax a tune from it In fact, the exact techn que is kept secret between teacher and pupils, having been handed down from an old hermit who discovered the art. Perhaps that is why the players cover their heads. They don't want tho passer by to solve the mystery of their music.

The blindfolded musician is reprintment of the English mummers, who in the holiday season disguised themselves and went from house to house to entertum their friends.



#### Bolsheviam by the Car-Load

BOLSHEVIK propagands, here's the way it is spread in Russia. A freight-car is fooded with Bolshevik pumpitiets and books and a few Bolshevista thrown in. On the outside of the car the Bolshavik platform is painted in large letters. A train of these cars starts out, and one car is dropped at each town, where it stays for several weeks.

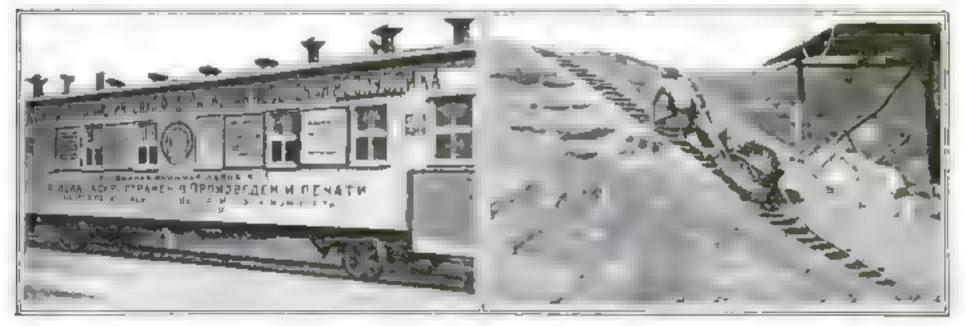
As the carious inhabitants gather around, the Bolshevists within the car hand out paraphlets and leaflets of all descriptions, with the idea of atimulating a taste for more. Then, when the villagers return, fired with a seal for learning, text-books are displayed. After some question-answering and a good deal of parteying the books are bought. Thus the Bolshevists make money, and at the same time they add new Bolshevists to their ranks.

#### A Coal-Mine Worked by Hand

If you sympath he with those who get the contout of the ground, put at the head of your list the Chinese miners. They have no machinery to help them and must work their mines entirely by hand. There are no alevators to carry them down into the mines, so they climb up and down, sided by a wooden ladder that is laid flat on the ground.

Below you see a Chinese miner climbing out of a coal-mine and carrying behind him a great chunk of lighte. In spite of the primitive methods used in this mine, it is said to produce large quantitics of coal

The mine is located near Peking, in the province of Shanal, where, it is estimated, there is enough roal to last the world for several thousand years at the present rate of consumption.





Should the dirigible be forced to make a landing on the water, this small collapsible life-boat can be blown up in three minutes; it will support fifty people

A Life-Boat for the Sea-Going Dirigible

" GO for a ride in one of our airplanes—price only \$15; this in-

The last two words of that advertisement—life insurance—suggest why flying has not become a popular sport. It is too dangerous for the average man to enjoy.

Germany contemportes starting dirigible air service to foreign ports, and she offers, as an inducement to the timed, the collapsible boat shown above.

When this boat is blown up it will support fifty people, even though it holds but about ten; the other forty must float in the water and ching to it. When the air is released it may be folded up to fit in a very small space. It takes but three minutes to blow the boat up. Our picture shows the boat just after it was launched from the dirigible in a test that took place on the Muggeisee Lake near Berlin.

#### Acetylene as a Substitute for Gasoline

WHERE hydro-electric power for making calcium carbide on a large scale is abundant, as for instance in Switzerland and the United States, acetylene may be substituted for gasoline in automobile and power-boat engines.

Careful investigations show that by diluting the acetylene with from twenty to twenty-five per cent of alcohol, gasoline, light tar oils, naphthalene, or a mixture of light tar oil and alcohol in equal parts, the explosive power of acetylene is sufficiently diminished and if enough air is admitted to the carburetor, the clogging of the

be prevented.

The scetylene, obtained from a solution in acctone, may be car-

engine by unconsumed carbon can

ried under pressure in iron cylinders.



With the weak that is to be done in full view, the palot operates the master switches of the electric boast from any aide of the pilot-house.

## Can Wood Be Used for Airplane Wings?

AN airplane's wings must be tough and light. Varnished linen has filled the bill heretofore, but today the Government Forest Products Laboratory is experimenting with plywood—thin sheets of wood placed one on top of another with the grain crossing alternately, glued, and then dried under pressure.

Plywood is light enough; but is it tough enough? The test consists in dropping a heavy metal ball from varying heights on to three layers of plywood, each

layer one one hundred and

fiftieth of an inch thick.

This will be continued until the toughest type of plywood has been discovered.

He opened the clamps and let the ball drop—
it broke through the thin layers of plywood in this fashion different kinds of plywood arc testeti for toughness

#### Electric Hoists for Lighters

In many modern lighter ships the old-fashioned donkey engines and clumsy winches that used to clutter the limited deck-space have been supposited by electric holets with an increase of about fifty per cent in efficiency. The steam plant for driving the generators and the motors in below deck. The mutom are of the

are equipped with magnetic brakes, in motor in genred directly to its winch, and the winches are arranged in two rows, one above the other,

The awitches for controlling the housing apparatus are located in the pilot-house. They are in implicate and are so arranged that the pilot can control the hoists from any point where he can obtain the best view of the operations.

The controllers do not control the motors directly, but operate a series of magnetically actuated switches mounted below deck which make the actual connections.

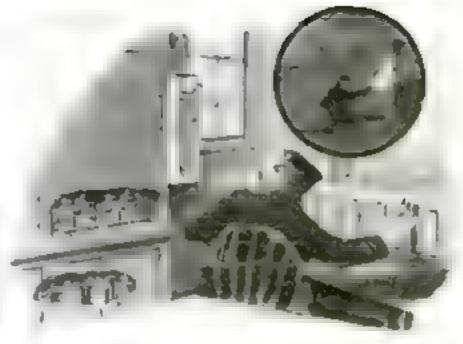
When the pilot turns the master switch to the speed required, the magnetic switches close in the proper order and at a rate that will prevent the burning out of the motor while giving the maximum speed that is consistent with safety.

## Making Safes Safe

## Thereby causing an old art to become almost extinct

By P. Schwarzbach

Clang! A bell sounds and an indicator swings around another safe is being cracked? As the man in charge reaches for his telephone, be looks at his indicator board to see which safe it it. A complicated system of wiring connects his batteries with the room to which the safe is kept the door, the windows, and the safe are all wired. What chance would Jimmy Valentine stand today?



REMEMBER Jimmy Valentine, the tender-hearted, nimble-fingered safe-cracker? Had he existed to-day, chances are he would never have became famous, but would have been nabbed on his first job. For invention has helped to make safes safe.

Let us suppose that Jimmy comes to life and decides to try bis hand at a large sale of large content. He approaches stealthily, and discovers wires that indicate the presence of an alarm system; if he has had no experience with wires he may decide to cut or ground them.

In the first case he releases a relay by destroying the line current, and in the second he energizes another by increasing the current. In either case he unwittingly sounds the slarm.

"Ten years of hard labor," says the

judge a few weeks later.

Suppose he ignores the wires and boldly forces the door of the room in which the safe is located? Again a relay is released and the alarm sounds in the central office. Or should he try the window, either by opening it or smeshing the glass, the result will be the same. Raising the window trips a spring that breaks the circuit, and smashing the glass severe a tinfoll strip that is also an important part of the circuit.

#### The Central Burglar Alarm

This complicated system of circuits and switches is known as the "central burglar-slarm system"—nor does it stop at the windows and doors. Suppose Jimmy should miraculously get inside the room without disturbing the switches? He approaches the safe and kneels down before it.

Foiled again! There is another circuit-breaker under the rug that will quickly report to beadquarters.

And the last circuit-breaker is in the safe itself, when the burglar starts to drill or melt a hole in the safe, a resistance wire within is either cut or fused, and the alarm sounds once more.

#### A Safe that Whirle

And now for another safe safe, invented by Patrick Mechan, of Brooklyn, New York, that is known as the whirl ing safe. When the owner of the safe decides to close up for the night, he starts a motor located beneath his safe and below the floor. The safe, which stands in the corner of the room, starts whirling, and at each revolution a light flashes and a bell rings.

Jimmy decides to try his luck at it. He stands watching it for quite a while; there is no one passing by outside. The safe is whiching too fast for him to try his hand at the combination; it is located in the corner close to the wall and

there is no chance of his hanging on while it whirls -he would be knocked off and thrown down violently.

There are just two possibilities: he can stop the motor or climb to the top of the safe and drill through it. But, if he stope the motor, the light that flashes and the bell that rings at each revolution will stop too, and the neighbors will know that something is wrong.

Jimmy figures that his best plan is to drill through the top. He climbs up the frail latticework behind the safe and breaks away the part that covers the top of the safe.

Cloud A loud alarm rings throughout the building. Jimmy jumps down, and flees just in time to save himself from enother ten years in prison.

> The breaking of the latticework caused the alarm to sound. As Jimmy thinks it over he is sorry that he didn't risk stopping the motor, instead. But if he had the result would have been the same; for the whirling safe is equipped with a second slarm that automatically sounds when the supply of current is tampered with.

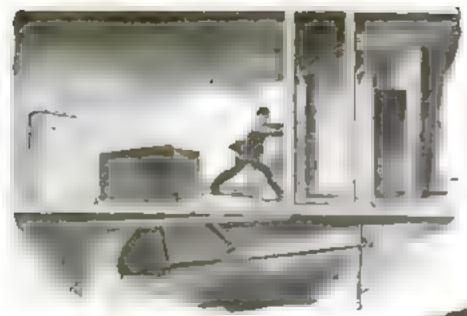


The whirling safe. At each revolution a bell rings and a light flathes. The burglar can't try to work the combination he dares not stop the motor since the light and belt will stop too. What is selt for him? He might climb the lattscework behind the safe and jump on to the top of it by breaking away the part that covers the safe but the result? An alarm will sound throughout the building

#### Helping Out the Watchman

One of the oldest, simplest, and best methods of guarding a safe is to have a watchman keep a constant sys on it. But suppose the watchman should be called away for a short while? Well, there has been invented a safe-protector that will guard the safe while he's gone. It was invented by George C. Smith, of Cambridge, Mass.

The watchman estimates the amount of time he will be gone and the hour at which he will return. He then sets an indicator at the time he expects to return, adjusts a weight attached to the clock, and goes out, quietly shutting the door after him.



Tropped! As the burg'or crosses the room the safe drops through the floor. Fearing a trap, he rust en back to the door to get that a second has been all this happen? The opening the door forces a projection in front of the door down into the floor; a series of levers does the cest

The weight causes a projection behind the door to rise up when the door is shut. If no burglar tries to force the door,

the projection will hold its raised position until the hour at which the indicator is set. At that time a shifting of weights will cause the projection to drop back beneath the floor level, and the watchman may enter without having anything unusual happen.

But suppose Jimmy should try his luck in the meantime? He opens the door cautiously, and the raised projection in front of it is forced down. When he is half way across the room the sale suddenly drops through the floor!

Junmy realizes almost at once that he is in some kind of trap, and rushes back to the door. But by the time he gets there a second outside door has awang shut, and he is next, nught.

All he can do is jump down after the safe and sit on the edge until the police come to take him away.

#### What It Was that Hoppened

A series of levers caused the safe to drop when the projection was forced down, which in turn awing the trap-door shut. The inventor suggests that the safe be

made to fall on cushions, so that it won't be damaged by its drop through space.

But why endanger the sale and perhaps the lives of the police who come to get the burglar, argues one inventor? It is not necessary, says he. According to his plan, you knock out the burglar before you go after him. As the burglar opens the door of the safe a small hammer drops down and breaks a bottle containing strong chemicals, the fumes of which will promptly knock the burglar out and keep him unconscious for several hours. In the meantime you cart his limp body to the police station.

If these different inventions are put into effect, safe-breakers will be forced to go into the second-story business.



He spreads out his tools, unconscious of the fact that he soon will really be unconscious. When he ravings open the door of the safe, a harmer will drop down and break a bottle containing strong chemicals the furnes will knock him out for several hours. When he comes to he will be in the police station.

#### Turn the Switch and Heat Your Bath

APARTMENT dwellers in big cities, accustomed to bot and cold water, electric lights, gas ranges, and other modern conveniences, sometimes forget bow much comfort these conveniences mean to them and how much less fortunate are people who live in the country, where conditions are comparatively primitive.

Often it is necessary, under these conditions, to pump the water at a pump in the yard, heat it in a kettle or pan on the kitchen range, and pour it into the tub, continuing this procedure until there is water enough for your bath.

How often would you he inclined to bathe if you were compelled to do all this preparatory work every time?

The difficulties are not quite so great where electric current is available. Farmers whose houses are lighted with electricity may enjoy the luxury of a hot bath without much trouble if they provide themselves with electric heaters. One of the simplest electric heaters in the market is that above in the accompanying picture.

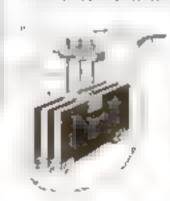
Three carbon electrodes, in the form of rectangular plates, are bolted together in a parallel position, about three quarters of an inch apart, by means of an insulated bolt. They are suspended by conducting rods from an insulating bar and have at their upper ends connecting posts, to which the electric wires are attached.

If the carbon plates are submerged in the water and the

electric current is turned on, the water in the bath-tub will quickly be heated. If one of the two outer electrodes is cut out, the intensity of the current will be reduced to fifty per cent; if the middle electrode is disconnected, to thirty per cent of its initial power.

With a current of 220 volts and from 20 to 34 amperes, 250 quarts of water may be heated to both temperature in about an hour.

The same principle is employed in a can for heating water, coffee, or other bquids. The electrodes are in the form of concentrically placed cylindri-



cal rings. The heater requires a current of 220 volts and 25 amperes and heats the water or other liquid, poured in through the tubulature near the bottom, in a few moments.



Submerge the electrodes in the water of your bath tub, turn on the current, and in an hour your bath was be ready



Here you see the single rails in place just before the concrete is poured in they are bolted to the ground

When a curbing is needed, a double rail is used. The curb above is finished and the rails will soon be removed

#### Rails that Help Make Concrete Roads

MORE and more are concrete roads being built, and with them come new steel forms of many kinds for supporting the concrete while the roads are under construction. The pictures above show two different kinds of steel rails that are being used by a large road construction company.

The simpler of the two, the singierall, has what is known as a slip - joint connection for joining rail to rail. At one end of each rail there is a metal projection held in place by a steel strip that is riveted to the top and bottom flanges of the rail. At the other end there is a groove into which the neighboring projection fits. The steel strips that form the groove and the other steel strip that holds the projection of the near-by rail in place, extend beyond the edges of the flanges and have holes in them to receive the stakes that fasten the rails to the ground. The rails are kept in place until the road is finished and the concrete has hardened. Then they are removed and used over again.

The double rail is used when a curb is to be built. The tailer rail is boiled to the ground and the shorter one hangs from a "spacer" that connects the two. The spacer has a bolt-hole in one end and two grooves in the other end. A bolt is run through the hole in the spacer and through a hole in the suspended rail. One of the grooves in the other end of the spacer is bolted to the large rail.

When the curb is finished the suspended rall is removed first. This is done amply by unbolting the groove in the spacer and lifting spacer and rall together.

## The Reason Why Shotgun Shells Are Grooved

WHIR-R-R' Bang! Bang! Missed again. As you reload, your eye falls on an empty shell and it occurs to you that the grooves in the brass cap seem to be rather flattened out. On comparison with

n loaded shell this proves to be true.

Do you know why the grooves are made in the cap? No? If they weren't there the paper tube would

"cut off" from the brass cap.

This is the same shell,

before and after firing Note the increased

length and flattened

grooven of the shell

that has been fired

When smokeless powder first came into use for shotgun shells there was endless trouble on this account. At the moment of explosion, the expanding gases jammed the cardboard against the sides of the barrel, while the brass cap was forced back against the breech bolt, thus tearing the paper tube and the brass cap apart.

Finally it occurred to one of the big manufacturers to stamp grooves in the sides of the brass cap to allow it to lengthen slightly without separating from the paper tube. This was done, and the cutting off ceased. The illustration gives an excellent idea of the increase in length of a shell after being fired.



The new rug washing machine is oper ated like a vacuum cleaner sotating rubber brishes with the aid of maptuds make a carpet as clean as when new

#### Here's the Way We Wash Our Rugs

VITH hands clasped before her, the lady in the picture below and at the left bears over the machine on the floor, a joyful smile flooding her face.

You really can't blame her, for, right before her eyes, her dirty carpet is being washed as if by magic.

An electric machine, which looks like a vacuum cleaner laden down with milk-cans, is doing the work. The cans contain, not milk, but soapsude that are fed to a pair of rotating rubber brushes below.

The rubber that is used in these brushes is soft and in consequence they penetrate the hap of the carpet to its very roots.

The scap compound contains no harmful chemicals or animal fats. It is made, according to a strict formula, from vegetable oil. Besides lengthening its life, this gives the carpet a fresh, sweet smell.

The brushes rotate at a rate of five hundred revolutions a minute and scrub a rug much more quickly than the human hand could possibly do it. Besides, the job is not a dirty one—note the clean white jacket on the man who is pushing the machine around.

## Cleaning Up After the A. E. F.



All convicts he was a few mainst an applicate the new sets make an account of the simple to France, removed the convers and the new set of the significant to France, removed the convers and the new sets of the significant to the converse and the sets of the significant to the sets of the sets



Three hard out soft someth and non-skin. In a sures of the pinns of the first of the sure of the sure



You will then from the white and wide a reward of the form the board will provide the property of the same and the same an



Here you see some of the burning surplanes that were purposely fired in the general cleaning up process in France. The government mays that only those parts that could not

be sold or used were destroyed in this bonfire, and that the financial loss was not very great. There is a law that prevents the government from giving anything away

## When the Human Herd Stampedes



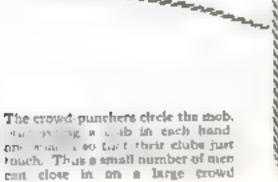
If you are skilled with a least take a tope with you and hard it at an extension you keep away to be as a property of host care to have and property to get a way to necessarily

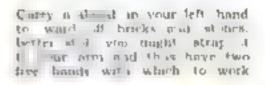


Once you've got him you can't, a bus on the head and are as and he it big if he was he without his cycle are structured by the cycle are structured.

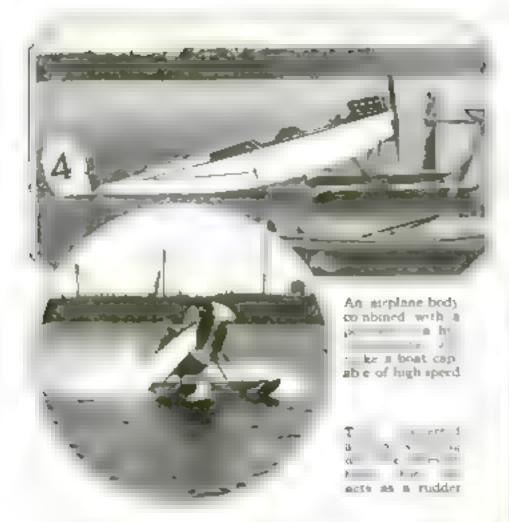


From the way be a brong on that question and concluding the I made, and the median terms he are the first with a quartery of a society lab a brighten









#### Out of the Air into the Sea

WHEN an airplane's flying days are over and it is pronounced unfit for service, must it die in the strap-heap? Not necessarily; it can shed its wings and become a boat without much trouble. All it needs is a cast-off pontoon of a hydro-airplane on which its bow end is pivoted

Such a boat is shown in the pictures above. The propeller, hody, engine, and tail came from an airplane, the pontoon from a hydro-airplane. The tail is used as a sudder and is controlled by wires leading to the cockpit. With its hundred-and-fifty-horsepower motor it can travel at a speed of fifty-five miles an bour.

On account of its aerial propeller it is able to run in shallow, weedy water where an ordinary motor-boat would become badly entangled.

#### How Fast Does a Bird Fly?

RECENTLY an English naturalist rigged up screens of very fine silk and wire threads, and with this contrivance he was able to record the speed of birds flying through

the screens in exactly the same way that the speed of a bullet is measured

fle found that blue rock pigeons did from twenty-aix to thirty-three miles an hour, the speed varying in individuals; that English pheasants at their best did thirty-three and eight tenths miles an hour, and that the English partridge's speed ranged from twenty-six to thirty-four miles an hour.

Carrier pigeoms timed in long-distance races have been found to range in speed all the way from fifteen miles to fifty-five miles an hour. The average speed of the carrier pigeon has been estimated to be thirty-five miles an hour.



Contrived for locating buried shells, that after-math of the war so dangerous to agriculturists, this electric divining-rod is useful to finding underground pipes

#### The House of Straw and Clay

BERLIN and New York have one thing in common — the lack of proper bousing facilities for their thousands of workers. New York's excuse is, chiefly, high cost of labor and material; Berlin's excuse seems to be lack of material.

And the outcome? Berlin is using new and different materials. Below you see a house of clay and straw under construction. It is one of many such houses that are springing up in the suburbs of Berlin.

Clay with bits of straw sticking out is not a pretty sight; but if it keeps the cold out in winter, it will be



Owing to the lack of building materials, houses of clay and straw, mixed, are now springing up in the suburbs of Berlin.

#### An Electric Divining-Rod

A NEW electrical divining-rod, if we may use the term. for locating buried iron, has been invented by a French ecsentist. Its object is to discover unexploded shells buried in the fields of Flanders, that constitute a source of danger to agriculturists.

The apparatus, with slight modifications, is also serving industry; for it is now being used to locate buried water-pipes and valves.

The working of the Hughes induction balance, as it is called, depends upon the strength of the current in two induction coils remaining equal, or balanced. The coils are situated as shown in the picture, one in each of the rings that you see resting on the ground. They are both supplied with alternating current from the same source, and consequently

both carry exactly the same amount of current in the ordinary way. While the current remains balanced in this way there is no sound to be heard in the telephone receiver that the operator is using.

When, however, a piece of iron is brought into the vicinity of either coil, the balance is upset, and sounds may be plainly heard in the receiver.

By moving the balance about and noting the strength of the sounds, the exact location of the buried iron can be determined.

Thus has science, instigated by the war, brought the immemorial hazel-twig divining-rod up to date.

#### A Power Plant on Wheels

"WELL, Jim," said the boss to the foreroan of the machine-shop, "here's a power unit that will work all the old hand threaders—no alterations, either and do the job in just one eighth of the time it takes us to do it

He indicated a one and one half horsepower electric motor that he was trundling along. It is a machine which was specially designed to be moved about to any place at which its services are required, and, although it weeks over two hundred pounds, it is so nicely balanced that one man can bandle it with ease.

The motor is controlled with a simple switch and has a two-speed gear. The speed is changed by merely pushing in

or pulling out a knob.

No universal foliate or chains, or other cumbrous mechanism are used, for any differences in height or distance are taken up by simply running the unit back-



#### The Metamorphosis of a Pair of Suspenders

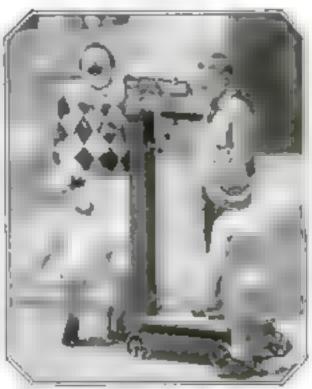
THE comfort of suspenders and the beauty of a belt—how can you combine these two no that the fat man in the office may take off his coat in hot weather? A Canadian manufacturer has solved the problem by making suspenders that may be quickly and easily turned into a kind of double belt.

The three sets of fasteners that are attached to the suspenders are unbuckled when the suspenders are to be transformed. You tuck the fasteners carefully in your pocket, so they won't get lost, and wrap the remainder around your waist. The buckles that once held the fasteners are now brought together, buckled and your suspenders have become a belt. The most satisfactory material is subber webbing, though leather is also used.

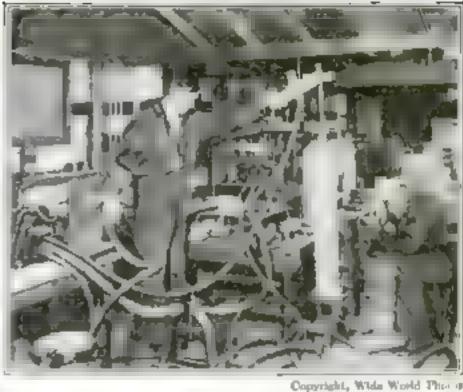
Our illustration shows an erstwhile beit on its way back to suspenderdom. The last pair of fasteners are being elipped into place.



You detach the fasteners on these suspenders, and the suspenders are then turned into a belt, buckled with the same buckles that originally held the fusteners



This is Cho-Cho, the great health clown, whose business is to laugh actool children into taking good care of themselves.



The man who appears to be peering through a relescope is really looking to find out how hot the furnace is

#### How Hot is the Furnace? Ask the Pyrometer

THE electric furnace is the magin crucible in which modern nichemists perform their wonders. The one shown in the picture above is of the 'tabe" type

It is often necessary to know the temperature of the contents of the furnace, and for this purpose an instrument called an optical pyrometer is used. That is what the man sitting down is using. He is looking at a brightly glowing, or incandescent, body noide the furnace. The instrument measures the light that the incur lescent object gives off, which varies with the temperature. By making a certain calculation he is then able to determine the temperature of the furnace

#### He Is Called Cho-Cho the Health Clown

I I you want to be healthy, eat plenty of carrots, spinsch, asparagus, and letture." Your pala, thin, anemic, cranky school-teacher told you that many years ago and, as usual, you paid no atten ion to her. But if a clown had danced into your class-room, carrying on his arm a basket of vegetables which he placed on the desk, and had taken out of it a carrot, some spinach. asparagus, and lettuce, you would have been all attention. And if after cracking jokes and making faces he had extolled the virtues of the carrots, you would have run home from school and demanded carrots for dinner.

The tale of the clown is not a wild dream. His name is Cho-Cho and he knows what he is talking about for be has spent years in studying the laws of health.

By his antics and games he impresses on the children the proper things to eat and drink, how often to baths, and how to keep and play.

This little stove will heat water or milk and can be taken apart and carried in your pocket or your grip with no danger of leaking

#### Slip a Stove in Your Pocket

OOK at the pletures. Just a nume and a spiritstove? Yes, but this stove will burn liquid fuel without any danger of explosion, and can be carried in your bag or pocket without leaking.

There are only three parts: the reservoir, which carries a tin collar, the burner, and the boiling-pan. The burner is interesting because it does not burn from an ordinary cotton wick. The wick is flattened out at the top, and is brought into contact with an asbeston pad. The spirit souks into the pad by capillary attraction, and a large indestructible burner is thus formed. The flame will boil water in a few minutes.

#### Another Motor Bicycle

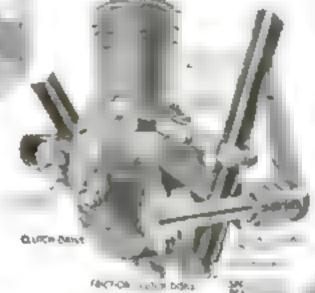
EVERY morning Mr. Tyvald Christensen, of Staten Island, N. Y., motors down the street on his bicycle. There s nothing unusual about a motor-driven bicycle, but this one of Mr Christensen's is different from all others. He made it himself

The motor does not trot along beside the rear wheel, but is neatly tucked in between pedals and saddle.

There are three great differences between this motor and the usual bicycle motor. It has a clutch, the magneto or current generator is run separately; and the muffler was

removed from its place in front of the cylinder and placed underneath the crank-case.

What are the advantages of these changes? The clutch and-chain drive gives the bicycle a smooth start. Running the generator separately obviates jerks and strains. The new position of the muffler gives the cylinder free circulation of air.



Making a motorcycle of a bicycle is easy, mays Mr Christenson lauread of tacking on a third wheel he installs this motor on the machine steel

To remove a button you slip it into the slotted base of the button remover and premon the handles

#### Button, Button, Off with the Button

LIP, clip! Off come the shoe buttons one after another. In less than a minute you can strip a pair of shoes if you use the button-remover invented by John Baldwin, of Grand Rapids, Mich. You slip the button into a slot in the base of the device and press the handles together. Off comes the button, and with it the metal fastener that held it to the shoe—and the shoe is not torn

The slotted base is made in two layers—the upper one being part of the upper bandle and the lower one part of the lower bandle. When you press the handles together the base parts, jaw-fashion. The top jaw pulls the button and fastener upward and the lower jaw tends to flatten out the fastener so that it will open up and alip through the boles.

#### An Oak Tree for a Derrick Mast

"SAY, what's the boss looking at?" remarked one of the construction men who were erecting a cotton-mill up in New Hampshire. "He's been standing there chewing his stogle and staring at that oak tree for the last ten minutes."

Next day they found out the trend of the "supe's" thoughts when he announced that the oak tree was to form the mast for a derrick.

The mill was built in the center of an nek grove, and several of the trees had been left standing immediately outside the walls. It had occurred to the job super-intendent that it would be a waste of time and money to erect masta for the construction derrick when a natural mast was already, at hand

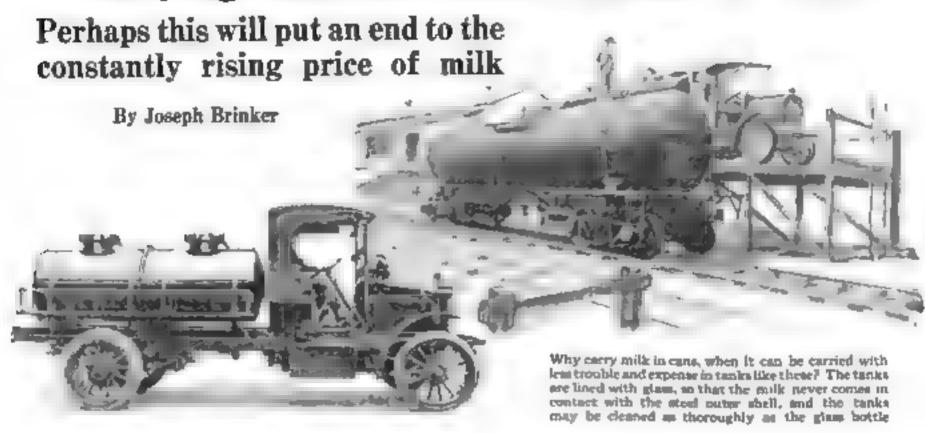
The boom of the derrick was secured to one of the sturdy branches with large timbers and heavy bolts, and the winding machinery was set up in a convenient position among the trees.

No real damage was done to the grove, as the trees used had to come down in any event for the sake of light.



By using a tree for a derrick most one contractor saved time and money. It was hard on the tree but he chose one that had to come down anyway in order to let in the hight

## Carrying Milk in Tanks instead of Cans



Did ever occur to you that the cost of milk delivery is app oximately twelve per cent of the cost of that milk to the final consumer?

Milk is one of our basic food products. Its price is steadily rising higher and higher, and with it the high cost of living. The farmer blames the distributer and the distributer blames the larmer; meanwhile the price of milk continues to rise.

The cost of milk delivery may be divided into four parts. First, there is the cost of the head from the farm to the ratiroad; second, the head to the city depot by train; third, the head from the railroad depot at the destination and to the city pasteurizing plant, and, fourth, the final delivery to the housewife. In the final delivery to the housewife, it is, of course, impossible to make the deliveries in bulk because the milk is bought in quarts. But in the other three phases of delivery it is entirely practicable to deliver in bulk instead of in small quantities.

Under the present scheme of milk distribution the farmer pours his milk into ten-gallon cans and hauls it or has it hauled to the nearest railroad to meet the milk train going to the nearest large city. It still remains in the ten-gallon can while in the refrigerator car, and when it is taken off and again hauled to the city pasteurizing plant.

#### Repeated Handling Adds to Cost

This means four separate handlings from the time the milk leaves the farm until it arrives at the pasteurising plant. First, the farmer puts it into a tengallon can; second, the man who hauls it to the railroad siding unloads it into the milk-car; the third handling is the unloading from the freight-car to

the truck to carry it to the pasteurising plant; and the fourth, the unloading at the plant.

Now, it is a fair law of transportation that any kind of goods can be moved more cheaply in large units than in small ones. Furthermore, this principle has been put into practice to an extent that, though comparatively small, is sufficient to indicate the possibilities of revolutionizing the entire system of milk transportation.

#### The Tank Can Be Put on a Truck

This change will come about through the use of tanks carrying from five hundred to one thousand gallons of milk at a time. It seems patent that the cost of handling a gallon of milk in thousand-gallon lots would be less than handling it in ten-gallon cans.

The first place where tanks of large capacity can be employed instead of ten-gallon came, without any considerable change in the existing equipment, is in the collection of milk from the farms and its transference from dames to condenseries or the like, when no railroad haul is involved. In this class of work it is necessary simply to mount a milk-tank on a motor-truck, and the truck will do the test. A truck equipped with such a tank is shown in the illustration above.

Milk concerns have not followed this plan before because they were afraid that carrying milk in tanks might lead to contamination caused by the contact of milk with metal. There is no longer any ground for such fears, for the tank shown in the picture is lined with glass and none of the fluid ever comes into contact with the steel outer shell. Furthermore, the tank may be kept scrupulously clean, for it may be flushed with hot water or disnfected

with live steam in the same manner as are the glass quart bottles now.

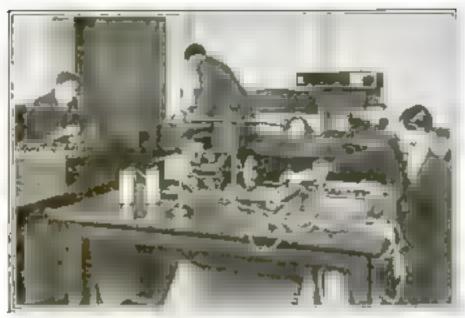
This tank has a capacity of five hundred gallons. It is made of steel, lined throughout with a thick glass enamel. This enamel is fused into the body of the steel itself at a tremendous temperature, so that the finished material combines the strength and resistivity of steel with the easy cleaning qualities of glass. The glass lining extends over the flanges and to the outer edges of the filling man-holes at the top, so that at no time is the milk in contact with the metal. The tank is held firmly in place, so that the glass enamel will not be cracked while the truck is in motion.

Many such tanks as that shows are now in use to haul cream from the dairy to the creamery and to haul milk from the dairy to the bottling plant or condensery.

#### And Why Not a Tank-Car?

There is no reason why the same idea cannot be applied to railway transportation as well as to motor-tracks. We have oil-tanks and chem.cal-tanks on railroad cars. Why not milk-tanks? In fact, Mr. F. T. Craft, a milk dealer of New York, in testifying before a commission inquiring into the high cost of milk in that state, predicted that a combination motor-truck and railway-car tank service for handling milk in bulk would revolutionize the entire present scheme of milk transportation and would be one of the big factors in reducing the cost of milk to the final consumer.

By the use of tank-trucks in the country, tank-cars on the railroad, and tank-trucks again in the city from the railroad depot to the pasteurizing plant, milk handling could be put on a bulk haps.



He is determining the speed of the motor's rotation by observing the spokes on a disk that revolves with the motor, through slits in a hood mounted on a vibrating tuning fork

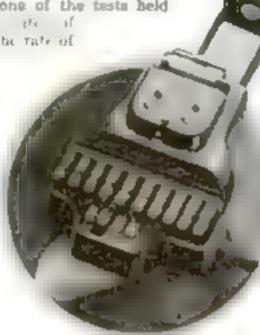
#### What Is Its Speed?

WHEN another train is running beside the train you are riding in at the same rate of speed, you have the sensation of standing still.

This principle is used in one of the tests held by the Massachusetts Ins. it of Technology for determining the rate of

a motor a rotation Mounted on the shaft of the motor there is a white disk on which spokes like those of an automobile wheel are painted in black.

You start the motor and watch the revolving disk through two sits in a hood that is mounted on the prongs of a vibrating tuning fork. You adjust the speed of the motor until the spokes on the disk appear to be stationary. Knowing the rate of vibration of the tuning fork, you are able to calculate the speed of the motor's rotation.



This machine which weight only four and a half pounds, will make legible, printed shorthand notes

#### Welding Tracks with a Steel Rod

CLINK, clink, chak—every time the wheels of your train cross a rail-joint you hear that clink. If you have nothing else to do you take out your watch, note the time between clinks and figure the speed of your train. But you won't be able to do it long, for they have taken to welding rail joints instead of leaving them open, thus safeguarding the lives of rails, wheels, and passengers.

A new welding machine and the welder are shown herewith at work. The machine is simply a cast-fron resistance-box having an automatic throw-out switch and a circuit-breaker that will shut off the current when the machine becomes

overloaded. The steel rails are welded together with steel.

He welds the steel rails with a steel rod that he holds in his hands at as connected with the resistance box.

#### A Prohibition Launching

PERHAPS it was the bottle of mineral water we don't know but anyway the Penguin didn't even try to stand up when she was launched. She toppled right over You see, it is quite possible that such a great disappointment at the moment of her debut was too much for her

There is another reason, though a more practical one. The launching was made sideways, and as the ship neared the water the stern found the ways. The how swung out and the ship thited to an angle of seventy-five degrees. Workmen cut away the interfering ways and the ship righted berself

The Penguin is a steel trawler, one hundred and fiftyone feet long, and having a 26-foot beam. She has a speed of fourteen knots.

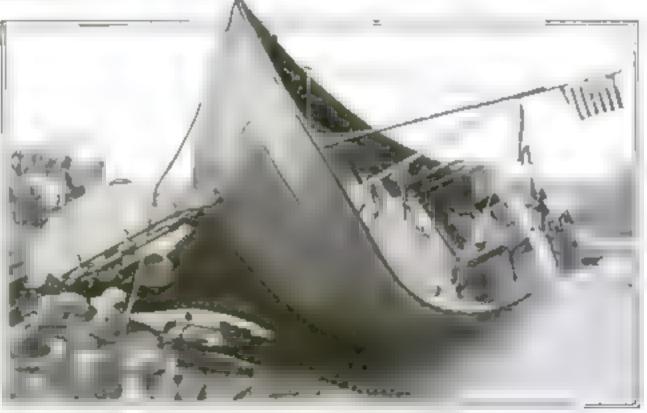
#### Taking Shorthand on a Machine

NO more agenizing over cold notes! A machine has recently been invented on which stenographers can take down shorthand in unmistakable and legible printed form.

The machine uses ordinary letters singly and in various combinations. The keyboard is arranged so that any or all the keys can be struck at one time, for the operator will frequently use three or six or eight or more keys at a time.

The stenographic notes are recorded on a long strip of paper that reminds you forcibly of that in an adding-machine.

Consonants are written according to sound, and vowels according to spelling. It is stated that notes can be made as quickly as by hand, and much more regibly.



She was christened with immeral water, and she toppled right over when she hat the water. She was built in Cleveland, Ohio, at a cost of two hundred thoupand dollars, and is the first steel trawler ever launched on the Great Lakes.

#### Snapped as They Crashed to Earth

Traveling at terrific speed one false move will hurl the rider through the air

> Resource sand the last fence and landed on his neck his feet Sying in the air the jockey landed on his back several feet away Neither of them was burt in this specimenlar spill, which took place directly in frunt of the photographer's camera



The motorcycle, dashing across the sand but a bole leaped into the air. formed over a transfer or sec-as 500 sec. fe<sup>5</sup> on transfer but his passenger in the same shot head first into the sand they were budly shaken, but fortunately is impalsion with taigreat power that a country medium a parter

#### Keeping His Kit Up to Date

WHEN the modern yeggman is ready to start on a job, does he take stock of his kit to make sure that he has incorporated the latest ideas in tools? 'Twould Beeth Jo.

His most recent addition appears to be the oxyscetylene

blowpipe. At a recent safecracking operation the burglars cut through the side of a perfectly good burglar-proof safe in a most nonchalant manner with the and of this tool. They then blew out the lock with nitroglycerine and helped themselves to the loose cash in the safe.

Even the scientific burglars strike a snag now and then though, and a manganese-steel-lined safety box was proof against the persubsive powers of the oxyacetylene. The criminals left behind them a large hammer and two cylinders of gas. The police subsequently discovered that these too had been atalen.

Our picture shows the hole they burned in the sale, together with one of the gas-cylinders. cracksmen made use of the property of the firm they were robbing in a most promiseuous fashion. helping themselves to everything they required, from baking-soda to the employees' clothes.

#### Things that Cotton Will Make

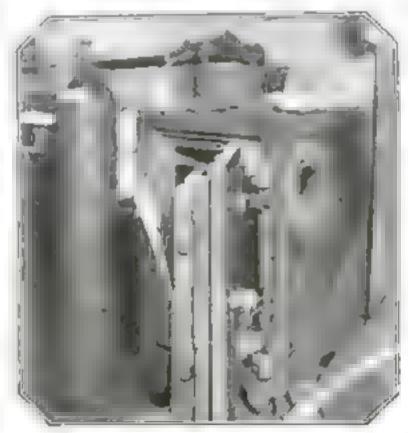
OST of the so-called tortome-shell r ms that are put around eye-glasses never had anything to do with a tortone. What are they made from? Cotton! In fact, many umbrel a handles, bairpins, combs, buttons, buckles, bracelets, and covering for French heels are also made from

> This sounds strange, cotton. doesn't it? Nevertheless, it is true.

> The cotton is first turned into these paper; this is threaded, dried, and dusted. Next the paper threads are dipped into a mixture of nitric and sulphuric acids. The water is pressed out of it and the remainder is ground fine. It is mixed with other things to form doughlike mass.

> Under hydraulic pressure the dough is kneaded and mo'ded into cakes. The cakes are sliced and hung up to season. Dies cut the engierial into its final form and it is shaped, polished, and drilled,

> While the material is still plastic the proper dyes are added. The most common colorings are imitation ivory, tortoiseshelt, and pearl. We can add to the list of cotton-made goods mentioned above, ivory and tortoise-shell dresser sets, "shell" tops for handbags, and even the covering for shoe syslets.



This burglar-proof safe was burned through by the use of an aryacetylene blowpape. Then the lock was blown out with aitroglycerine

#### The Flash-Lamp that Needs No Battery

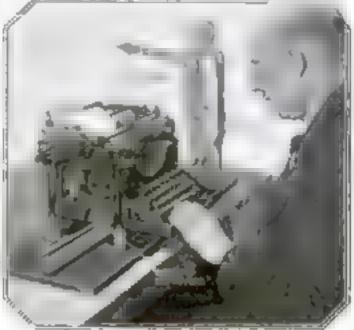
C'\ '. You turn on your flashlive why's dead again. It siways seems to go dead when you need · mest Can a flash-lamp be man that needs on bothersome It can. The flash-lamp makes its own You pull the ring at the end of the chain; a spring winds up-

and the little armature within whirls around. This lights a two-candlepower bulb. One pull on the chain makes the light flash for five seconds. This is long enough to find your way around a sharp stairway, or to find a key-bole.

American dougherates Ita own electricity Copyright International Plus Service boys in the St.

Miluel drive and afterward, captured a number of these contrivances. Some were found with handles like a conductor's punch. The Germans had them in and around their dugouts at points where they could be picked up conveniently for night excursions.

Doubtless many of these odd little generators found their way into this country as war souvenirs,



When you hit the letter "A" the arms of the doll move to the signal position "A"; thus you learn the signal system

Wooden Deer of the North

A STATELY pine, with a little fix-If you doubt it, observe the pine here, Yes, it is a pine, though it looks more like a starving, weak-kneed deer. The body, legs, and tail are one slice of the pine tree, and the head and borns unother

When he pulls the chain

the ight will flink for five

peconds, that flesh amp

has no ba

The owner simply put the head and body together, nailed two axle-grease boxes to the head for eyes, and stood the creature on its legs.

It is a strange looking beast, but its master is quite proud of it since he discovered it. If you would like very much to see this wooden deer you will find it standing pear the railroad tracks at a spot about a mile north of Minnekahta, South Dakota.

#### Bringing the Machinery to the Work

HERE are many drilling, grinding, and polishing operations that could be done much more economically by taking the machine to the work instead of the work to the machine. A portable power unit has been devised to cope with just such situations.

The machine consists of a 1/4 h.p. electric motor, mounted on a base. It is equipped with a switch, a three-speed counter-shaft, and five feet of flexible shalting, which terminates in a toolspindle. To use this machine it is necessary merely to connect it with the nearest lamp-socket.

The new unit is primarily designed to do away with the moving of large castings for the sake of performing small operations on them, but it is equally useful on small objects. It is easily portable, and comparatively inexpensive.



This wooden deer was formerly part of a pine tree the body, legs and tail are one the head was tacked on and so were the eyes



The little motor on the floor savet the cost of moving the big casting across the shop to the stationary grinder

#### This is a Wigwagging Typewriter

FOU'VE seen beribboned dolls tied Y to automobile radiators and doneing dolls bouncing up and down on talking-machine records, so you won't be surprised if you see athletic do le festened to typewriters and filinging their arms wide every time a key is struck.

Such a typewriter, with a man working at it, is shown in the picture above. It is a new way of teaching flag signaling. Suppose you wished to learn the signal alphabet. You would strike "A" on your typewriter and the doll's arms would fly to the wigway position for "A"; and so on.

Strings leading from the shoulders attach the arms to a pair of parallel bars fastened at one end to the side of the machine. The other end is free to move downward under pressure. At right angles to the parallel bars and directly above them are the arms to which the keys of the typewriter are attached

Each arm is notched. Take for illustration the letter "A." You hit the key and the arm depresses the bars below just enough to force the arms of the doll to take the signal position for "A."

The notching, of course, must be done very carefully, so that the arms will move to the proper position for each letter.



Copyright International Film Service

He signed a contract to play caveman in the movies, and later decided to shave; but the law would not let him

#### The Law Will Not Let Him Shave

F you never got a shave and hair-cut. you would look like the man above. You don't want to, and so you shave. He doesn't want to, but he can't shave; the law won't let him.

For years he, Henry Francis Koser, earned a living by playing caveman in the movies. And then he met the girl; she didn't like his beard—he decided to shave it off-the movie director heard of it he took the case to court. The result? Mr. Koser is forbidden by law to shet his hair until his contract explres.

#### Something New in Motorcycles

THE average weight of a motorcycle is three or four hundred pounds—not an easy weight to proper by foot, as hecomes necessary when the engine atops.

A new motorcycle has been placed in the market which weighs only one hundred and tenpounds, develops a speed of from thepty in to the remiles an hour, and is said to run one hundred and forty miles on one gallon of gasokne, under ideal conditions. The machine presents several novel structural features. The engine, which is usually placed between the legs of the rider with its weight almost evenly distributed over the two wheels. rests entirely on the rear wheel of this new model, placed to the left of the wheel. and to avoid overbalancing the spokes are offset sufficiently to accommodate the engine and to bring its center of gravity in a line with the plane of the wheel.

In case of engine trouble, therefore, the rider would have no difficulty in pedaling his machine.

#### Into the Wilds with Pockets and Pencils

UNKER'S coat of many pockets has just as

Interesting a tale connected with it an Joseph's coat of many colors. William Junker, a Russian explorer, designed the coat for a trip in which he tried to trace the course of the River Welle in Africa. Each pocket has its particular job one holds his watch, another his thermometer, another his compass, still another his aneroid,

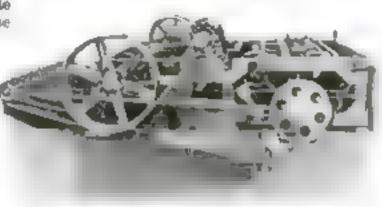
From one button beng three penrils, a blue, a red, and a black one. With the red one be marked his route, the blue one traced the

rivers, and the black one the time of starts and stope.

Mr. Junker wrote down the approximate width, breadth, and direction of course for every giver and stream encountered. Woods, grasslands, deserta, mountains . all of them were noted on the day's map. This care-

ful account of every move was of great service to geographers. He traveled four thousand miles and his average speed was three mues an hour

and several more has notebooks. This explorer's cont in full of pockets for holding his watch, compass. thermomenotchooks he carrice a red, a blue, and a black pencil on strings these he uses in making maps



This muchine bends the leaf springs to the desired shape and holds them until there is no danger of shrinking and warping



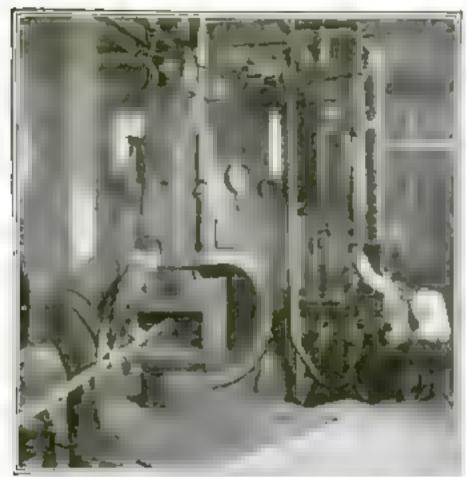
Light weight, easy control, and a drive wheel the grip of which is increased by the weight of the engine are the most striking features of this new model

#### Making Leaf Springs by Machinery

OR several hundred yearsin fact, ever since the invention of steel-leaf aprings have been made by rolling or hammering steel to the form of a band or ribbon of the desired width and thickness, cutting it into the required longths, bending each piece to the desired form, and finally reheating and tempering it in oil or water to give it the necessary degree of hardness and elasticity.

The hammering frequently arguments are a spots and made its enstacity During the heating and tempering process many of the springs became warped. The ar is tion of machines for rolling the steel and for holding the springs in shape during the heating and tempering slightly improved the results, but did not eliminate all defects. The first material progress was made recently by the invention of a machine which bends the leaf spring true to shape and holds it while it is immersed in the tempering oil bath until there is no longer any danger of shrinkage or warping

After this operation is completed the tempered less spring is released and dropped on a metal conveyer belt which carries it upwards out of the bath to the dryer



This government owned forging press can be used for research work by anyone who has real experimental work to do

#### Government Aid in Steel Work

THE extent to which the United States government during the war angaged in experimental and research work is steel rolling and forging problems is probably not fully realized.

The illustration shows a large forging press in the metallurgical department in the building of the Bureau of Standards at Washington which was extensively used during the war by various interests to try out a number of ideas on forging certain alloy, carbon and special steels. The results obtained were of incalculable benefit.

A 16-inch rolling mill was installed in the same department, and both mill and press are still at the disposal of any steel company that may be desirous of working out problems of an experimental or research nature where rolling or forging is involved.



This is a buby toucan; he rests on spiked albows, waves his claws in the sur and cries constantly for food he is a most unattractive creature

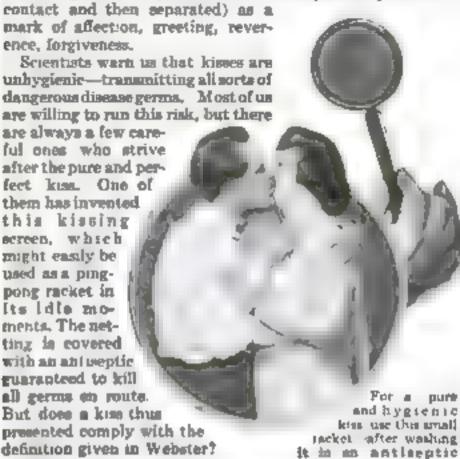
#### What an Ugly Baby!

THE toucan is an ugly bird with an enormous beak and a grotesque body. And his new born child is worse. Did you ever see anything quite as ugly as the creature in the picture above? It is a baby toucan. He rests on his elbows, which are fortified by spiked pade, waves his claws in the air, and cries all day for food.

Until a few years ago nobody had ever seen a baby toucan or even the egg, nothing was known of the bird's home life. It was purely by accident that an explorer happened on a toucan nest in a jungle tree near Bartica, British Guiana. The nest was located in a natura cavity in the tree, about three feet drep. Two white eggs lay on a bed of mold and nuts. The explorer chopped down the tree and kept the eggs. One of them developed into the baby above.

#### The Pure and Germless Kiss

A KISS, says Webster's Dictionary, is a sweetmest made of the beaten winter of eggs and sugar, baked; a drop of scaling wax; or pressure with the lips compressed on



#### Push Your Portable Drill from Hole to Hole

PRILLING holes and wheeling buby carriages become kindred jobs when you use the portable drilling machine shown in the illustration below.

The drill is mounted on wheels and you push it around by means of a pair of long handles. When you come to a spot that needs drilling, you slow up to a stop, turn on the power, and press down on the handles to keep the drill in place. When the hole is finished you move on to the next one, comfortably pushing your drill in front of you.

The drill measures twenty-two inches over all and weighs one hundred and twenty-five pounds. In the picture below it is



This drill is mounted on wheels and is pushed from hole to hole by the operator, it works particularly well on ship plates

## A Winged Horse in Reel Life



Harry Piel and his horse article thrills for the Certain movie fates thrill is dropping from a dirigible by parachute from an ablitude of eight hundred and fifty fort, here you see Mr. Piel and his bewildered horse just leaving the ground

Ready for the drop. The rider is calm and comfortable, but the horse isn't: he doesn't know what to do with his legs. The parachute in looped over a bar just above the rider's head

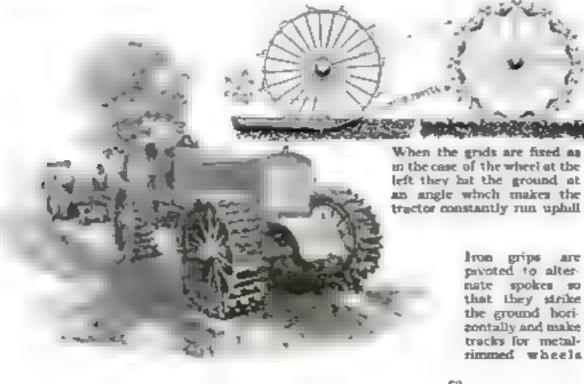
and here you see them gently gading toward earth. The horse, with his eyes glood to the ground is probably swearing that if he lands safely, nothing will ever induce him to fly again

#### This Wheel Lays Its Own Track

HERE you see the latest thing in the tractor world. It consists of the usual hub, steel spokes, and a rim, upon which, at alternate spokes, are mounted iron grips.

These grips are pivoted so that they are always flat on the ground at the point of contact of the wheel with the ground and thus serve in the place of a metal track.

One of the advantages claimed for this new type of wheel is that the power delivered to the wheel is transmitted horizontally instead of upwards, as is the case in an ordinary steel wheel with fixed rim and cross cleats. In such a wheel the ground is packed directly in front of the wheel and thus the tractor always runs uptill, which wastes power



#### Wood that Competes with Steel

WHAT a the hardest wood? If by "hard" you mean enduring, lignum-vite, the "vital wood," Is at the top of its class.

Lignum-vite is the only wood ever discovered that can be used for the bearings at the stern end of the propeller shafts of steamships, and practically every large steamship in the world is dependent upon a block of Ignum-vites for a smooth running screw.

The reason this wood, which is found in the West Indies and in a few other parts of tropic America, is tougher than any other wood is found in the arrangement of the wood fibers. Instead of running up and down, they weave back and forth, cross ug and recrossing each other in a manner that resembles the weave of an automobile tire.

Another peruliarity about highumvite is that when the wood is cut the sap cells fill up with a very heavy resin, causing the wood to weigh approximately eighty pounds a cubic foot. 'It is therefore about one third heavier than water, and, while excellent for propeller-shaft hearings, would make a mighty poor life-raft.

## There's Always Something New



Unless one uses the speedometer shaft lubricator shows above, the greate around the shaft hardens and tenda to slow it up or perhaps eventually breaks the gear in the revivel joint, The lubricator forestalls forgetfulness on the part of the cas-owner

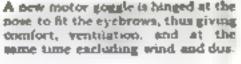


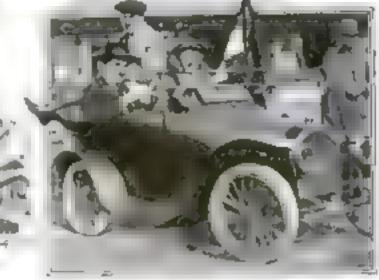
the factor of A new motor goggle is hinged at the

It is claimed that this invention provides a variable speed clutch and control mechanism to replace the friction clutch and variable speed gear used in automobiles

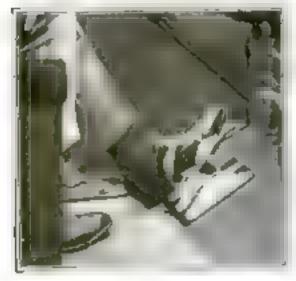
SHOWS COLLA

Signification

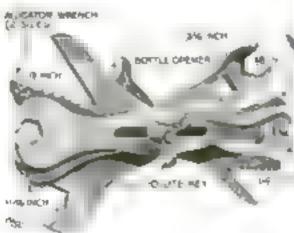




A skid device for dual or double rear motor truck tires is made of metal cross pieces held by a chain in the groove between the tires

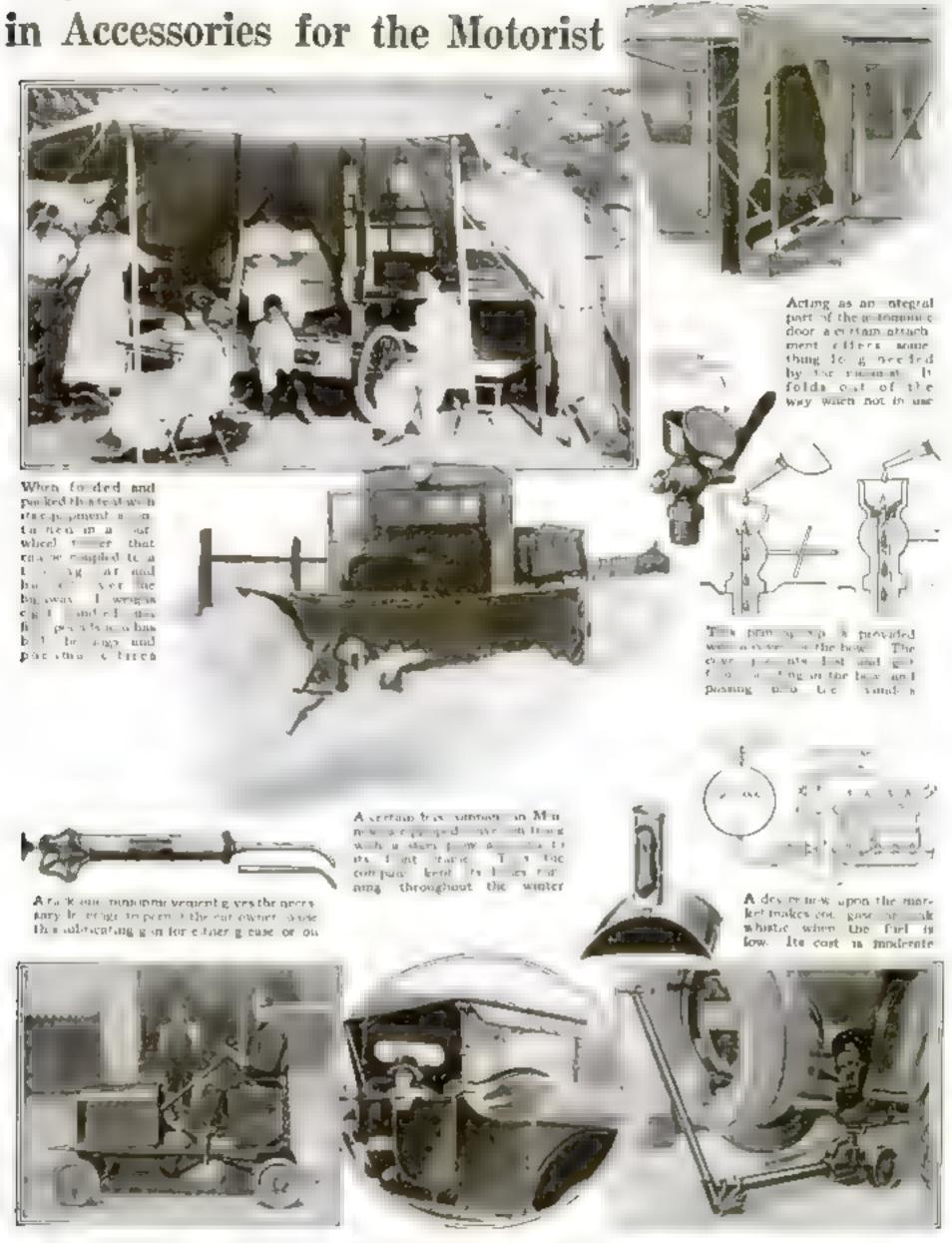


A set of these little begu dealgged to fit over the Ford opersting pedals prevents bot and cold air from entering through the fluor-boards of the car



The four-layer automobile wrench fits right different bolts and nuts. opens bottles, and serves in the capacity of increasing when necessary

With the smallest sutomobile cagine this car comes from France. Five years ago it sold for \$950, recently it brought \$1 500. Eddie Richenhacker was its old paint



No, no one stepped upon this Ford. It is built this way purposely to do short hading in and out of factory buildings. It turns around in a very short radius

The swring frame is made of steel and the covering of waterproof ranvas. It comes in different mass to fit any make of car and its position is easily adjusted. With the advantages of short construction, wheels pivot, enormous leverage, and a high handle that cannot strike the car body, this jack is only forty inches over all

### Using Up the Coal Crumbs

## One way of staving off the exhaustion of the coal supply

By Ernest Welleck

ANY years ago a French writer and philosopher was asked what he considered the most striking difference between human beings and animals. "Animals," was his terse raply, "are always wasteful; human beings only in times of plenty."

The American coal industry furnishes a typical illustration of the truth of this epigram. With almost incredible wastefulness surface outcroppings were first depleted; later the coal underground was attacked. Only the largest and richest veins were worked, while the thinner and less early accessible reins were neglected and buried under masses of biasted rock.

For many years cost was principally marketed in large blocks. The small sizes, usually mixed with low-grade culm, the tailings of eost mines, were piled up in enormous heaps which were often destroyed by spontaneous ignition. In those days of abundance, when it seemed impossible that the supply could ever become exhausted, nobody even thought of utilizing the low-grade tailings of the mines. Millions of tons were dumped into rivers and lakes or used for filing low ground in place of earth or rock

The intensive development of our industries after the Civil War created an ever-increasing demand for coal. Coal production developed by leaps and bounds and soon reached enormous figures. It became clear that the available coal deposits were by no means unlimited.

And so, at last, the method of mining coal was improved, making it possible to work even minor veins of inferior coal with profit. But it was not until the increasing cost and scarcity of coal made greater efficiency in its use imperative that effective afforts were made to bring about greater economy in the utilization of coal.

#### Pulperized Coal as Fuel

Among the most recent of such efforts are the numerous inventions of methods for using pulverized coal as fuel in steam-generating plants. The possibility of accomplishing a considerable saving by the use of pulverized coal in the furnaces of stationary plants and of locomotives has been demonstrated most convincingly by tests which also proved that greater heating efficiency could be obtained by this method.

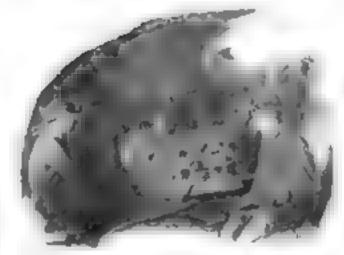
The economy and reliability of pulverized coal is beyond dispute. This makes it possible to "use up the crumba" by utilizing the mountains of acreenings and tailings accumulated at the mines of the rich coal districts, as well as the low-grade coal, heretofore considered worthless as a fuel, which is found in large deposits scattered over wide areas in different parts of the United States. This coal contains a very low percentage of fixed carbon and volatile heat-producing matter and as extremely high percentage of meombustible mineral matter which forms large clinkers when burned by ordinary methods.

The picture on the opposite page shows the complete installation for burning pulverised coal at the Oneida street power plant of the Milwaukee Electric Railway & Light Company. This plant has been in operation for about two years and has been eminently successful during that period. It was installed without making any change in the settings of the bollers other than a tranzangement of the fireboxes, and gives them a much higher capacity and efficiency than was obtained by the use of stokers. There are several different systems in use, but that Illustrated here shows, 'n a general way, the principles upon which all are baued.

The coal, which may be of very low grade, is unloaded from the car directly into a hopper, from which it is fed to the crusher. The crushed coal is carried by a conveyer to the magnetic separator, which removes the stray iron, such as bolts, pieces of tools, homesboes, etc. contained in the coal. By gravity or other means the coal is next carried to the dryer, where the water contained in the coal, usually representing from five to fifteen per cent of its weight, is removed by beat.

Apother conveyer takes the desiccated coal to the storing bins, from which it is conveyed to the pulveriser. By means of a chute the pulverised coal reaches a bin, from walch it is fed by a worm-screw feeder, the speed of which can be accurately regulated, to the combustion chamber of the furnace. If the combustion is well regulated and a sufficient draft of air is admitted, no slag or clinkers will be formed. The incombustible mineral parts of the coal will drop in the form of a coarse brown sand into the ash bin below, from which they are removed from time to time. The ash contains only about two one hundredths of one per cent of combustible matter as compared with thirty to forty per cent in the ash from other furnaces.

A careful test extending over a



With improved machinery like this, gven thin venus of inferior coal which formerly received no consideration may be worked profitably, if the coal is used in pulvenzed form in the boiler plants of industrial establishments

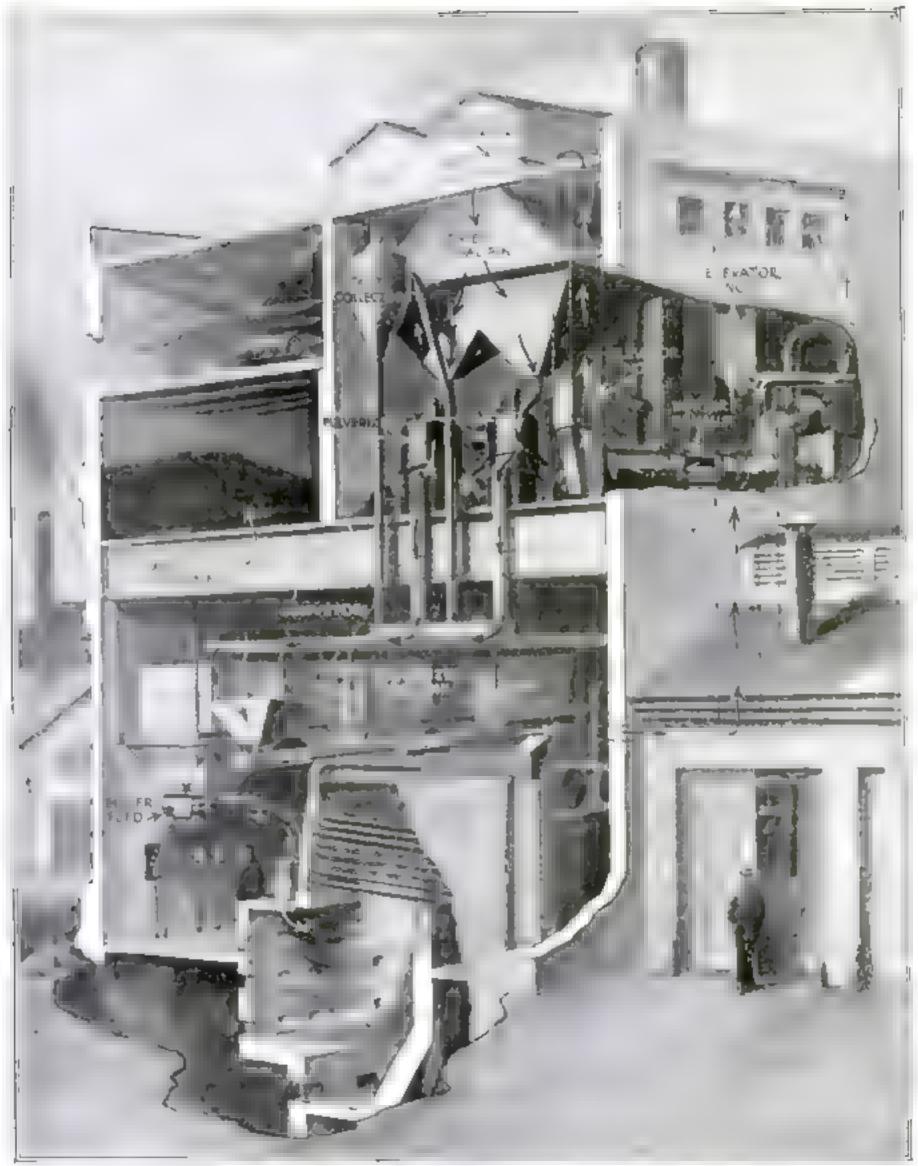
period of twenty-four house was conducted by the engineering staff of the Milwaukee Electric Railway & Light Company some time ago, and gave highly satisfactory results. Coal known as Illinois and Indiana screenings was used in the test. It contained about ten and five tenths per cent of water, nearly fifty per cent of fixed carbon, about thirty-s.x per cent of volatile matter, and when dry averaged 12,000 B. T. U. a pound. Combustion was virtually perfect; there was scarcely any smoke, and no carbon monoxide in the escaping gases. The ash residue represented only from thirteen per cent to fourteen and five tenths per cent.

#### Efficiency Test

The boiler efficiency was eighty-five and twenty-two hundredths per cent, and the net efficiency, after making deductions for the coal used in the dryer and for driving the machinery of the crusher and the pulverizer, was eighty-one per cent, or from one per cent to two per cent higher than had ever been obtained by the use of unpulverized coal and stokers.

With a consumption of 1,990 pounds of coal an hour an average boiler pressure of one hundred and sixty-seven pounds was maintained during the entire test, equivalent to 546.2 horse-power. During the twenty-four hours a total of 47,775 pounds of fuel was used for changing 893,168 pounds of water to steam. According to these figures one pound of fuel was required to evaporate nine and forty-seven one hundredths pounds of water.

Tests like that referred to, and the experience gathered by careful observations in other plants in which pulverized coal is used, prove conclusively that pulverized coal may be used advantageously in stationary beating plants with a saving of about ten per cent and a possibility of even greater saving in larger plants. The greatest efficiency is obtained with coal so finely pulverised that ninety-five per cent of it will pass through a 100-mesh sieve having 10,000 openings to the square inch.



#### Showing How the "Crumbs"-Pulverized Coal-May Be Used

This "broken-away" view of the steam-generating plant of the Milwaukee Electric Railway & Light Company flustrates the modern method of using pulverised coal as a fuel. It shows how the coal screenings which are stored in the large bin on the second floor are taken by a conveyer to the tubular drying chamber thence, having been thoroughly dried, to the magnetic separator on the roof. The separator removes from the coal all particles of from or steel that may have become nused with the screenings, to prevent them from breaking the steel cut-

ters of the pulverizer. The cleaned acreenings drop into a double bin, from which gravity takes them to the pulverizers, which are driven by powerful motors. Between the rollers and cutters of the pulverizers the coal is reduced to a fine, almost impalpable powder, which drops on a conveyer and is taken to a storage bin between the second and the ground floors. The fine dust arising is carried by the draft to the dust collectors whence it is returned to the bin. By a worm feed the pulverized coal is conducted to the combustion chamber of the furnace, and ignited



Copyright Informationna Film Horvies

When a battleship requires a new sult, the fating-room must be a large one. This is the U.S. S. Manusippi in drydock on the Partie coast

#### Giving a Battleship a New Suit

THE expression "like a fish out of water" has become, in our everyday speech, a summe for awkwordness and strangeness. It stands for the acme of helplessness. But a dreadnought out of water looks less like a floating fort and more like a ship, as the picture of the U.S.S. Messissippi in drydock at

Hunter's Point, San Francisco, shows. Notice the graceful, yachtake lines of her '10,000-ton bull as she lies there. She is the very essence of potential power—and of temporary impotence.

The drydock is known as the No. 2 dock, and has been used for the last year for repairing de-

atroyers. The Messisseppi is, however, the first battleship to enter it. Some fear was felt at first as to whether she would be able to pass the approaches, but she sailed in without a hitch.

#### Testing the Resistance of Concrete

THE usefulness of concrete depends principally on the degree to which it resists the crushing effect of pressure, and this, in turn, depends on the quality of the cement, the proportion of the crushed stone, size, or other material, the proper mixing and "setting," and the proportion and character of the water employed in its making,

The governments of many countries have established bureaus for conducting and standardizing tests to determine the resisting power of concrets.

The picture below shows part of the laboratory of the government testing bureau at Berlin. In the hydraulic press occupying the middle ground and capable of exerting a pressure of four thousand tons on every square

inch, a block of concrete is subjected to a crushing test.





The resisting power of concrete is tested by a hydraulic press capable of exerting a pressure of four thousand tons to the square inch

#### Bossie Takes a Chemical Bath

WHEN you have been out in the country in the summertime you have noticed the cows, as they graze, switching their take and tossing their heads, and sometimes subbing

themselves against trees and fences. Why do they do this? The files are bothering them, you say, and probably you think that fighting files is one of the inevitable penalties of being a cow. But it shouldn't be.

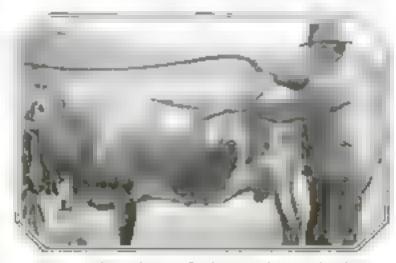
There are two kinds of flies that are the principal offenders, the stable-fly and the horn-fly. An important discovery has been made: that the more cown suffer from irritation due to these flies, the less milk they give.

In order to combat the evil, the dairymen, assisted by United States government agricultural experts, have discovered various mixtures that will kill the flies. The mixtures are applied with a spraying-pump. Our picture shows how this is done. The apparatus, consisting of barrels for the solution and a

hand-pump, is carried to the scene of operation in a wagen. The cows are tied to the wheels, and then one man pumps while another directs the spray where it will do the most good. The same spray-pump that is used to kill pests in the orchard may be used again for the cows.

Several mixtures have been found effective, but one of the cheapest and best is the following:

One hundred parts of flah-oil, fifty parts of oil of tar, and one part of crude carbolic acid. Any fly that can stand that has, in our opinion, a perfect right to live.



The peculiar shape of the nonzie on the hose makes it possible to force the disinfectant mixture through the thick hair and against the row's hide

They Monkeyed with the Buzz-Saw

## And now it turns rough logs into finished lumber at the rate of one million feet a day

T is probable that the first sawmill in the United States was erected at Jamestown in 1607. It was crude, and an improvement mechanically over the then common method, pit-sawing, only in that the work was done by simple machinery instead of, as formerly, by hand. In those first mills, wasteful and slow in operation and of light producing power, there was apparent but little progress toward better methods for very nearly two centuries, when a small circular saw supplanted the old "upand-down" contrivance that had been in use. This, in turn, retained its place for many years, finally to be supplanted in the manufacture of lumber by the very efficient band-mill of today,

In this field the American was the pioneer, and it is said that his mills, driven by windmuli or by water-power, later by the tides on the coast of New England, were cutting the virgin timber of America two hundred years before the running of a mill in England, where the first of them were broken up by

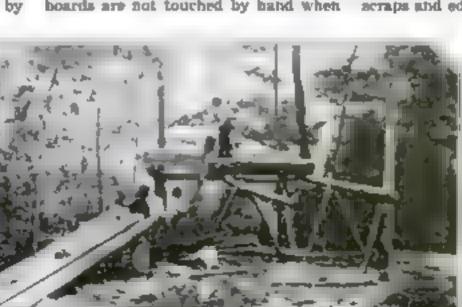
mobs of men, loath to see the appearance of any new labor-saving contrivance.

The American sawmill was not always. devoted exclusively to sawing timber; for wood was plentiful and ready at hand to those who needed it, and the exigencies of the times very frequently demanded food far more. Many of the earlier milling plants were for that reason a working combination of the saw- and gristmill; and the miller who received the settler's corn and ground it into meal was also, in many settlements, the mwyer who converted logs into boards.

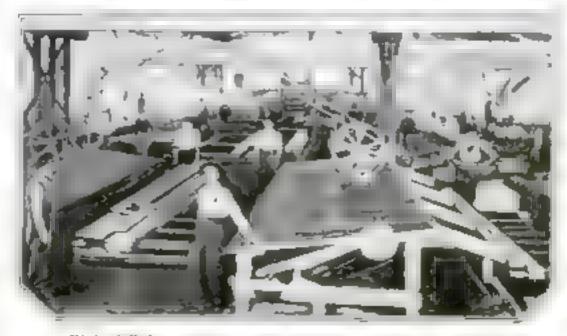
For many years after the advent of the first circular saws the mills showed few essential changes. Theirdevelopment, if not entirely arrested, was very alow; old ways continued, as they still continue in certain sections of the country. Then (not more than a generation since) came the band-saw, and with the band-saw greater speed and skill, and a daily cut greater by far than that of which the old sawyers had ever dreamed.

Steam suppliented wind and waterpower, to be later succeeded in some large-sized establishments by the electric motor. Crews of two men, the sawyer and his helper, disappeared with their circular saws, their overshot water-wheels and primitive log carriages. The larger timbers of the newer West and South made new demands, and native ingenuity proved equal to modern needs. Small logs and short carriages gave way to buge lengths of timber and carriages designed to travel at locomotive speed.

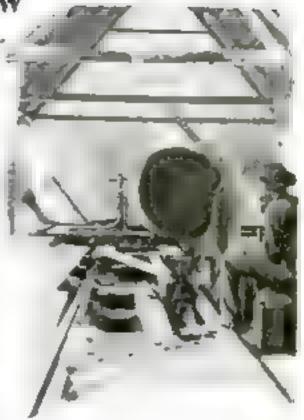
Though some work is still done by hand, and two or three men "ride the carriage" to fasten the logs in place after high-power machinery has put them there, the first small crews of two men, and sometimes even one, would today hardly suffice for a cut-off saw in the modern mill, with its thirty or forty men assigned to special tasks. The boards are not touched by hand when



Methods like these in the hills of Kentucky remind one of days when pit- or whip-suring was the only make spread



With skilled operators and fast, efficient band-news, from log to finished boards takes but an instant, and the waste is at a minimum



The old-time sawyer found many staff problems to be solved in the heavy timber of the Southern Appalachians

they leave the log. Endless chains carry them to the trimmers, graders, and loaders, while others carry the acraps and edgings to smaller machines.

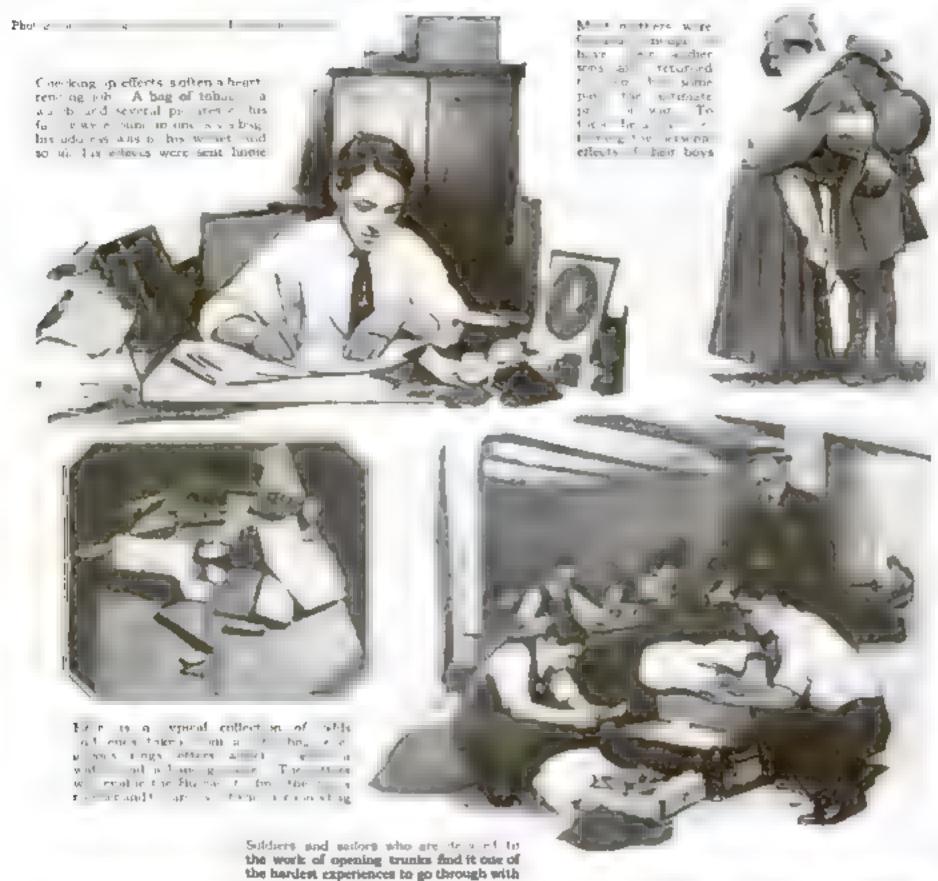
where they are turned to lath or other byproducts.

The head sawyer is a high-salaried employer who could throw away his wages in half an hour of careless cutting; for thorough experience, sound judgment, and a quick, trained eye are necessary adjuncts to improved machinery and the increased production it makes possible.

In many of the mills a double-cut saw passes through the log as it goes out and back: the carriage runs forward, a board is cut, the log advanced an inch or two, and another cutting made on its return. Great logs are handled, and disappear, in the twinkling of an eys. The first-class band-mill as a model of efficiency.

A few hundred feet of rough, uneven lumber in a day was the output of the early mili; there are plants in operation in the state of Louisiana that have in excess of a million feet in twentyfour hours for their unit of production.

## The Belongings of Soldier Sons Who Died





A complete record of every man who was killed is gradually being compiled by the Effects Bureau here you see several rows of boxes containing the completed records of many of the men

These trunks belonged to soldiers who died in France. The Effects Bureau in New York is trying to-locate the families of these men, there are four thousand unidentified trunks stored away in this room.

## Soda Will Have Its Day!

Here is the way they bottle it and distribute it in Washington

Harder's of rocks are to ble with the series being a the control and the series of a series sold of the United States of 918, power years.



T fints in it to what fine rate to a second fine rate to be a fine to the Lapset for the Lapset

Suptemp bother or files, a constitution of the same sake to the same of their plants of the same of th



See hand o'd bott on are fitted rate the riegoing caps and a but see a solution a pullified int of J them at each the batter are set ordered in o'dd water and then they are sent to the fishing deput ment

The board's are on their was though he trenches those in the bulkground are empty those? For ight have just been 6'ed those up from are being capped in the capping machine and await your order. But gentle reader, we make it to you has the waster the grin that goes with soda?



#### Each elevator holds seven cars, one above another on inclined floors much like the shelves of a narrow kitchen closes

#### The Elevator Garage

ID you ever bear of an automobile garage made up of elevators? Well, it's the very last word in garage design, and is likely to revolutionine garage construction in our large cities because it will hold six times the number of cars that can be stored in the same floor area in an ordinary garage building. While the new garage has what is equivalent to seven floors, the car-owner need not leave the main floor to bring his car in, take it out, or have it washed, although the washing is done on a second floor below the man entrance level.

The cross-sectional illustration shows the elevator principle employed. The building is half above

ground and half below, and is made up of a series of elevators with a wide side between. Each elevator holds seven cars, one above another, on inclined floors much like the shelves of a narrow kitchen closet. Each elevator can be raised high enough to allow the car on the lowest floor, or abelf, to run off on to the main floor, and can be dropped deep enough to permit the topmost car to run off in the same manner. By using forty-two such elevators; two hundred and ninety-four cars can be stored in a garage that would ordinarily store fifty cars. The elevators are of the hydraulic type and are operated from contrel statuess on main floor.

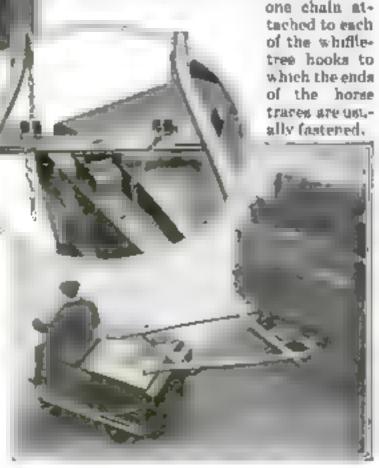
#### A Special Hitch for Pulling Wagons as Trailers

WHEN borse-wagons are pulled as trailers behind any kind of motor tractor, it is generally necessary to remove the horse shafts and introduce a form of special drawbar. This often requires a change on the wagon which makes it impossible for a horse to pull it again until the shafts are replaced. All this takes time, and so the Chirago manufacturer of an electric industrial tractor devised the interesting hitch shown in the pictures below.

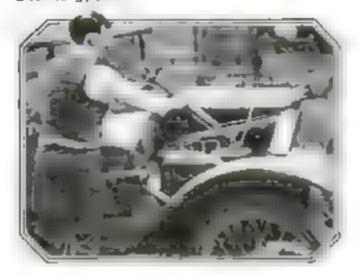
It is not necessary to remove the wagon shafts or make any changes whatever on the wagon. Thus, horses may pull the wagon to a certain point, and after the horses are removed, the tractor may haul it to another point and bring it back empty and all ready to put the horses in the traces.

The bitch consists of a horizontal bur pivoted at its midpoint to the rear end of the tractor. The shafts are placed on top of the bar, and are prevented from sliding off by upturned lugs at both ends and by metal cups placed over the ends of the shafts and chained to two other slotted lugs bolted to the bar nearer its center

One of the vertical links of the chain is inserted through the slot in the lug, while the next or horizontal link contacts with the vertical face of the lug. This makes it possible for the tractor to back the wagon, the pull on the two chains being exerted through the cups to which they are attached to the ends of the shafts. The forward pull of the tractor is taken through one chain attached to the center of the tractor at the rear and divided into two chains at its own rear end, with



Remove Dobbin from the shafts and bitch your tractor to the wagon in his piace. The special bitch eliminates removal of the wagon shafts



Detecting automobile engine ailments before they develop is the business of this new engine tester

#### Eliminate Guesswork in Engine Testing

WHEN trouble develops in the average automobile engine, it may be due to many different ailments, the most common of which are leaky piaton rings, improperly acting valves, loose bearings, piston Blap, etc.

Any or all of these troubles can be very quickly located by a new motor tester which

looks somewhat like the ordinary tirepump.

This tester consists of a small metal cylinder with a piston inside. The puton-rod extends out through the top, and is provided with a crossbar for both hunds of the operator. The rod is hollow and bas an air-gage at the outside and above the cross-handle. The device is attached to the sparkpany openings.

To test valves, they are first closed and then the tester handle pushed down. A leaky valve will allow the air to blow out through the earburetor or through the intake manifold to the cylinder that

in on the auction stroke. Il is principle of testing un idle eng wis new, but it is said to give good

results in every instance.

## A Portable Crane for the Garageman

EVERY garageman who has much lifting to do or many wrecking jobs to handle will be interested in the new type of crane shown in the accompanying illustrations. The apparatus is really half a dozen tools combined and its uses are almost limstless. For instance, inside of the garage it may be used for every

> conceivable kind of lifting work. Berng mounted on rollers, it may be moved from point to point without difficulty

Outside the garage it has just as many uses. First of all, it may be bolted to the platform of a motor-truck by removing the base with its rollers. In such a position it may be employed to support the front end of a Damenger car or a truck to tow it to the garage. It may also be employed to pull the damaged car up on

the truck platform, as shown in one of the pictures.

If the damaged vehicle happens to be down in a ditch beside the road, and out of reach of the crane cable when the crane is on the and of the truck plat-

form, the apparatus may be taken off the truck and anchored to the roadway nearer the wreck, so that the latter may be extricated first. Then put back on the truck the crane may be used

LANT PRINTS

COOK THE PART THE

COST COMMETTER STORY

LODGE MANY SURFACE

All the spack plugs

are removed and

the tester screwed into each opening to put the damaged car upon the truck platform, or to hold its front end if the rear wheels are undamaged so that it may be towed.

All of these uses are made possible by the fact that the apparatus is pude in four parts, easily and quickly taken apart, so that, no matter what the task, the equipment may be put in such form as to take care of it. One minute it may be used inside the garage for lifting the front end of a car to make a crankcase repair, and within the next five minutes. it may be loaded into the rear seat of a passenger-car or on to the platform of a motor-truck and sent out to succora damaged passenger-car miles out of town.

Briefly, the four parts consist of the base; the saddle and anchor-piece, the crom-beam, with the complete hoisting mechanism and chain and a crane extension member; and the king-pin. The base consists of two wooden arms mounted on rollers and held together by two crossed pieces of metal. These may be folded to save space when the apparatus is sent out in a passenger-car.



Here the crans is pulsing an

automobile out of deep anow

who e it was ampossible. For the egra which took as itsection

With the car lifted in this manner, it was easy for the mechanic to at bemeath it and repair the injured part

The car above had an accident that damaged its front. The crane was attached to the rear of a truck to pull at clear

A broken drive shaft crippled this car, so the crone bauled it up on a truck to carry it to the garage - a one-man job



WHAT'S an affigures good for anyway lafore he's made an our attractive pocket-books and DOLEN?

Well for one though if you muzzio bim ai dibitch him to a small wage to a will drag during a bottom reand the grove reader Other tis man as a Care Way e a b ca you can say was a cool door, a part of you.

There are several allegator farms In Florida, and the stunt of hernessing an alligator was first tried there. A pictore of an alligator drawing a small gire's cart is shown

Because of the size of the alligator's mouth he can t wear a bit and it was quite difficult to teach him to turn around corners.

He Peddles Dinners with

His Kitchen on a Pole N China you will find the danger peddler: he wanders through the streets carrying

his kitchen on his shoulder and shouting "Disner!" as he goes You hear h m hail him and he serves you a meal on the spot. This sounds like an ideal plan for elim-

instang the work of cooking meals, but it has one drawback: you never know when the peddler will show up. In fact, he may not show up at ad.

#### Oh, What a Shame to Cut It!

OSEPHUS DANIELS in Secretary of the Navy and he is a ways being remaided of it. He was asked to a danger recently, and after he had eaten everything from soup to roset, the demert was brought on. It was a hugo cake battleship with turrete, smokestarks, life-boats and guns all in place. It took the chef a week to make it and he used up a barrel of sugar. Mrs. Daniels received a cake cost of arms made by the same skilful chef. He is shown above amiling at his handiwork.

#### The Face on an Irish-Potato

"WHO put the Irish in potato!" asked Dr M Luckiesh of the Nela Research Laboratory of Cleveland, when he came acrom a potato that had a truly Irish face.

By photographing it in different lights he gave it many characters. Witness the grouchy old man on the left and, on the right, the fighter with one eye completely closed.

# The See-Saw Arrives

Tiple is ago as anyon h 1 - P (34) 3 PT - G - P - 18 we are of a se e too de that the Japron dun't call they don't song t or and down but Tas American

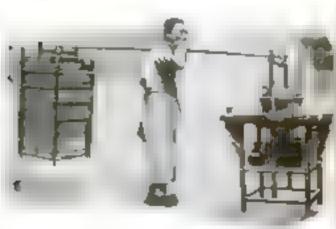
crae o de Japanese girl was caug'as by the ramera as she bravely walked on the narrow board that supports the sec-saws. You will surely agree that she is brave when you look at her feet: she is obliged to wear her clumpy closs even during her hours of recreation.

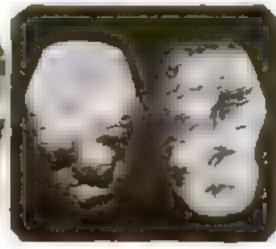
But there's one advantageclogs are cheaper than shows and last much longer,

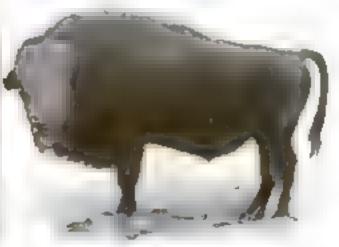
#### Meet the Cattalo, a New American Half-Breed

BUFFALOES are very strong and useful when tamed and many countries are louth to see them die out. Canada has taken to breeding buffacous with cowswhich are plentiful. The result is called a "cattale." One of them is shown in the picture below,

The experiments in croming buffaloes with cows are taking place at Wainwright Park which contains a soo-

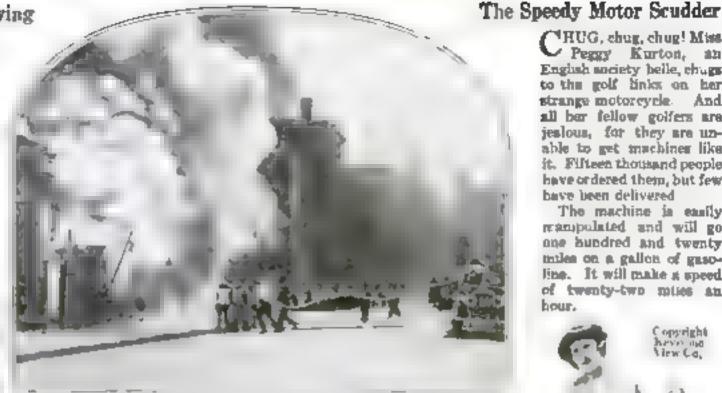






#### She Selle Time for a Living

TIME is valuable, particularly to Miss Belleville of Greenwich, England, since it is her means of livelihood. In fact, she sells it to watchmakers. Every morning she goes to the Greenwich observatory, has her chro-nometer checked up, and receives a document telling just how many seconds and fractions of a second her chronometer differs from mean time. She then goes to her customers and they adjust their watches accordingly



Copyright Press Bluster mg secret.

#### A Fire that Wasn't There

FOR ten blocks a great column of smoke can be seen. With bell clanging and siren shricking, the fire-fighting apparatus swings around the corner. The men swiftly get out a hose-line and atart the stream.

After the smoke dies down, an investigation is made for the purpose of fixing the rause and the

To everybody's surprise, no traces of fire can be found. The only untoward thing on the premises is a big patch of grease around the kitch-

A kettle of greass had upset on the hot stove top and this had produced a great deal of smoke, but no fire!



Music in the Air

AN a small boy drive a tank, equipped with a gasoline engine and regular accessories? One boy did. The tank was not the famous Britannia, however, not one of its cousing, but a distant relation made to a miniature scale

A Gne-Boy Tank

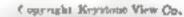
The Little machine was made for advertising purposes by a magneto manufacturing firm. It was an exact replica of one of the great war tanks, with the familiar caterpillar treads.

The motive power was furnished by a small gasoline engine, fitted, of course, with the firm's particular brand of magneto.

THE thought of riding in an airplane it a the general public with great excitement; but the veteran aviator who is constantly flying often finds himself distractly bored when up in the air. Airpurper are so well made now that there is little chance of adventure.

Below you see two aviators lifting a phonograph into their machine before they start out. Its music will entertain them on their trap. Sometimes, when even the music palls, they try transmitting it by radiotelephone to their friends on the ground

They must have to use an exceptionally loud needle.



<sup>4</sup>HUG, chug, chug! Miss.

Peggy Kurton, an

English society belle, chugs

to the golf links on her

strange motorcycle. And

all ber fellow golfers are

jeslous, for they are uz-

able to get machiner like

it. Fifteen thousand people have ordered them, but few

The machine is easily reampolated and will go

one hundred and twenty

miles on a gallon of gaso-

line. It will make a speed

of twenty-two mises an

opyright View Ca.

bave been delivered





# Making a Bird of the Airplane

The metamorphosis is accomplished simply by accordion-pleating its wings

By Carl Dienstbach

ERE you ever impressed with the beauty of a large stuffed bird a hawk, for instance—posed in the very act of jumping off into space? Didn't you want to see the thing come to life? But how would you feel if the outspread wings remained "stuffed" and you saw the creature walk, eat, and sleep in that same maggarated pose?

This little fancy explains perfectly why the eternally "spread-eagled" appearance of an airplane has always grated on sensitive nerves. Nor does the impression change if a purely utilitarian point of view is taken. So far, "stuffed wings" have made life miserable for the airplans-metaphorically speaking-just as for the bird Shunned by automobiles and boats, the awkward contrivance remained banished to rural flying-fields, far from the walk of life. It dared not show its face on streets or roads. To store a single forty- or fifty-foot machine required a building as large and almost an costly as a family mansion.

#### The Airplane's Aukicardness

Automobiles were eagerly sought by the buying public even in their early days, when they were both costly and dangerous. If the airplane so far has not proved an equally "good mixer," the reason may be explained not so much by expense or danger as by its authorities. In fact, folding the airplane's wings is a task far more imperative than has been generally resilzed. Nature's solution is ideal, but inimitable. Trying to compose artificial wings of sections that like feathers would be capable of "telescoping" over one another, yet having a smooth and strong surface, closed as well as extended, would be adventurous engineering. Swinging rigid wings back, parallel to the fuselage as has been done is only a half measure that still leaves the bulk awkward.

#### The Folding Wing

But along comes Mr J A. Weis with a plan that is plausible on the face of it, just because it has proved successful in a similar case—the floors of the immense sheds for mammoth dirigibles.

Some architect conceived the plan of anugly folding these tremendously large and massive doors into the towers that flank the shed's entrance, by "second-on-pleating" them. They are composed of parallel vertical segments which fold tightly one against the other, just like the slabs of a fan.

Virtually, Mr. Wels has done the identical trick with the wings of a biplane, by composing each wing of a number of parallel fore-and-aft sections which, folding one against the other, "accordion-pleat" the whole wing. But he had to find a way of performing this folding process from the central "fuselage," and the most natural method was to further dissect the wing's surface into tip-to-tip sections as well.



Can an airplane fo'd its wings like a bird? Mr Wess thanks on. He to demonstrating the mechanism of his folding wings. Here it is very nearly closed. Pressure on the lever will unstantly extend it

Now, he could "break up" one such tip-to-tip section and make of each wing surface a mechanism exactly like the well known "lazy-tong" device. In exactly the same way it could be extended or collapsed by operating one end of it-that next to the fuselage. Pivoting the interplane strute to the center of each principal "accordion section" kept them always upright and parallel to each other. The whole plan automatically made that part of each wing, where oppositely folding sections are joined to form the lazy-tong, the strongest; and, as wings usually possess two strongest tip-to-tip members, the wing spars—a second lazy-tong arrangement, corresponding to the rear sparwere joined to the center section in the rear. So Mr. Weis' whole wing consists of one central tip-to-tip section, against which a front and a rear tip-to-tip



Spreading its wings for flight. The pilot is pulling levers which extend the "lazy-tongs." In a moment the links of the tongs will be parallel, and the wings and supporting spars will be family locked into position.

This plan has fundamentally the great advantage that it leaves the structure of a collapsible airplane wing essentially the same as that of a non-loiding wing, especially as most of the wing structure and all stay-wires except the interplane wires are not disturbed or even affected at all by this sort of folding.

#### The Strength of the Wing

Thus it requires but little added weight to preserve the same degree of structural strength, because, generally speaking, only tensile strength must be compensated for, while compression strains are taken up as readily by "compounded" as by solid parts.

But metal was called for as building material, because perfectly regular
shapes of locking edges must be insured,
and furthermore only metal permitted
the splitting up of parts which were
none too bulky in the solid wood. The
necessary cutting up of each rib into
three separate pieces threw the tensile
strains of each rib upon the mentioned
substitutes for spars, subjecting them
to a tension which, in turn, required
that all the links of the lasy-tongs
be fitted as tightly against one another
as in a pair of sclasors.

Tensile strength had to be compensated for especially in link-joints of the lazy-tongs that occur just midway between the struts. To spread the wings, these lazy-tongs must be extended until all their lines become perfectly parallel with one another. Nothing would prevent opposite anks from payoting eventually in the same sense, and thereby annihibating all compressional resistance of the "spar" they compound. But Mr. Wess has provided an extension to each link beyond its pivot which effectively locks them all against any such motion. As spar strains are mainly compression strains, but little addition of material and weight in needed to lock them securely by this method.

#### Chief Difficulty of the Scheme

But what is the chief difficulty in Mr. Weis' scheme? I just mentioned it: spar strains are compression strains. Yet a lazy-tong, as even its name implies, is inherently extremely weak against any compression as long as it is yet the least bit folded. Only when it is extended into one perfectly straight line does it become suddenly strong, for the reason that it then ceases to remain a lazy-tong.

cess that would presuppose it would be done only in a perfect calm, because without stay-wires a wing's strength in nil in the wind. Again, imagine the folding of the wings after landing. That is easily done. The wires offer no resistance, but, on the contrary, after the least deviation has occurred from the parallel position of the links, "shoot" the tong in like a catapult.

But what will happen to the wing? Folded the least but it finds itself without any wire bracing (the wires instantly relaxing). True, folded a great deal, it becomes itself a truss. But how about the intermediate stage? A wing must not be folded before the machine has come to a standatill after landing, because the least air pressure on the wings during folding would prove disastrous.

The following remedy is suggested. All interplane staying should be made of continuous wire cables running over sheaves, just like the warping wires in the old Wright plane. These cables would have to be wound on motor-driven windlasses to take up the slack instantly and with the required force, also permetting "tuning up" stays instantly after spreading the wings. But all this presupposes very nicely perfected mechanical details.

Still, the folding wing is most desirable, for the following reason: hitherto the attempts to stop a machine a headway after landing were liable to result in the machine's jumping again into the air, followed by "paneaking." But with the wings instantly collapsed on touching the ground the tall may be depressed and the wheels braked to any extent. It also may be easily arranged that the shock of striking the ground automatically collapses the wings at exactly the right instant.

It is of importance to mention that experimental regular size wings, constructed for Mr. Wels by the famous Falcon airplane works in England, exhibited the same strength and only a fraction more weight than standard conventional wings.

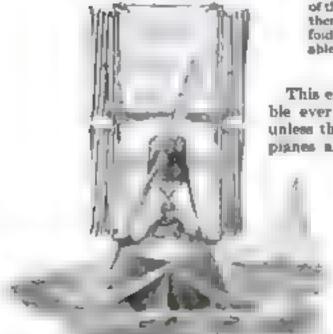


In fall fight. An extension to each ask of the "lazy tongs" beyond its pivot locks them so securely into position that the folding wings become quite as dependable as the more familiar rigid type

This explains why it will be impossible ever to spread Mr. Wets' wings, unless the stay-wires between the two pianes are so relaxed that they exert

none of their usual heavy pull against compression in the spors. It is hope ess to exert the least effort against the pull of these wires while operating the lazy-tong, because—owing to leverage—that would require a prohibitive pressure on the relatively weak handles of the "tong"

Yet the unavoidable tightening of each single wire after the "tong" has been "abot out" is a tedious pro-

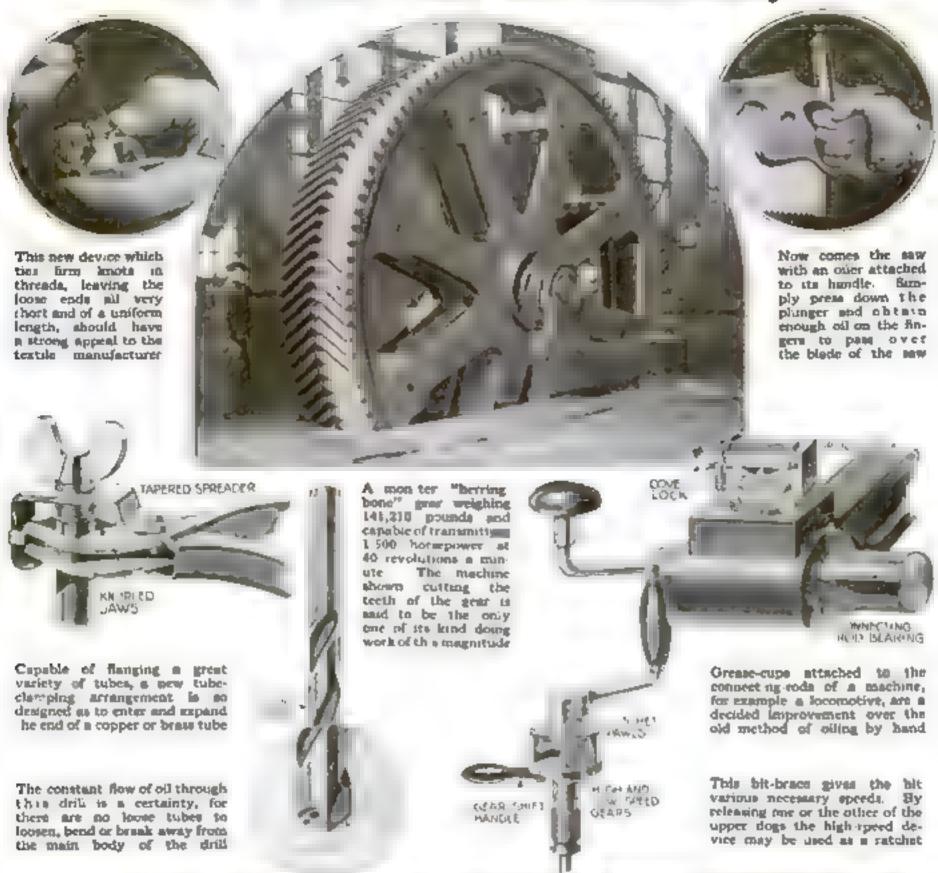


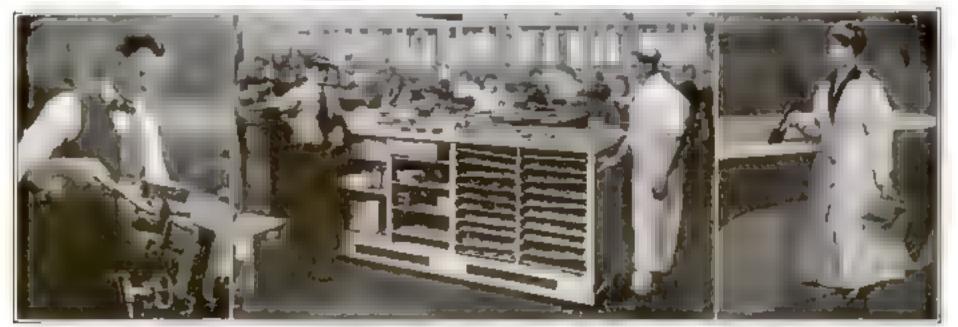
Folded close to the body, the flyingboat a wings are no longer an embarrassment when this man-made gull comes to rest or to swim on the water



With wings folded the machine can be stored in a garage. When the owner wakes to fly he has only to test atong the road to a convenient starting-piace

# Do It with Tools and Machinery



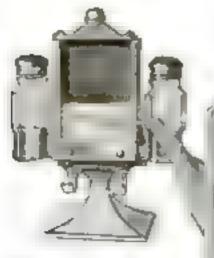


It is claimed that the device shown here will clamp all classes of work in almost any conceivable position

A moon and overtime rush in a certain factory restaurant deprived many employees of a considerable portion of their lanch period, hence this portable service stand

The "dope" for coating airplane wings is placed in a sperial air tight can to avoid evaporation of the solvents

Housekeeping Made Easy



Here is a receptacle for keeping toothpicks clean, set in the side of the salt and pepper shakers. From the little lever at the side, and one toothpick is deposited to your hand.



A vacuum device permits the used water to be drawn from the tub and ejected into the sick. It is easily attached to any water faucet and is economical in operation



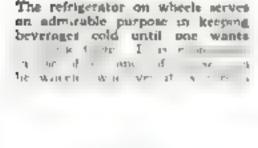
No more stringy eggs if you use the poschag spoon to lower them into the kettle. The bowl of the spoon is pierced with tiny holes



In case the jar is faulty

liquid creeps up the thermometer and you

must do it all over again





A small hand merated de vice it could proces spon the names combina even a child to make the most beautiful and intricate embroidery. It is easily carried in a hand-bag



This window-cleaning contrivance makes it possible to clean either the outside or the inside of a window without danger of falling



Sonk a porous stone in a pan of ketosone I en piace it among the furnace coals and ignite it. It starts the fire easily and can be used over and over again.



The ballast cleaning machine is built low so that it does not interfere with passing trains. Clean ballast means sound ties

# To Keep Ties from Rotting

RAILROAD ties are usually made of wood, and constant attention is necessary to prevent them from rotting. One of the most fruitful causes of trouble is the stone filling or ballast between the rails. Around the ends of the ties, as a result of the constant dropping of dirt and greass from the trains, the ballast becomes mixed with dirt. Gradually it buries the ends of the ties, allowing damp and other disintegrating influences to work havoc.

The old way of combating this was to fork over the ballast by hand. Now a machine does the work in a

The machine is a ministure chainand-bucket elevator, run by a gasoline
engine. The frame has guides at the
sides to keep it in the right position
between the tracks. It is moved along
by means of a chain-and-ratchet arrangement. The buckets dig up the
ballast from the ends of the ties and
deposit it on a wire screen. This is
mechanically shaken and the dirt is
sifted out into a steel pan, the ballast
sliding off the end of the screen back on
to the track

With this machine a crew of five men can clean about thirty-three feet of rail in forty-five minutes.

#### Welcome News for the Smoker

SCRATCH, scratch! No light! Scratch, scratch—what's the matter with these matches, any-way?

As a matter of fact, the matches are all right. It's the striking surface on your box that's at fault, and the war is to blame, of course! It caused a shortage in antimony, which is one of the ingredients used in coating safety-match boxes.

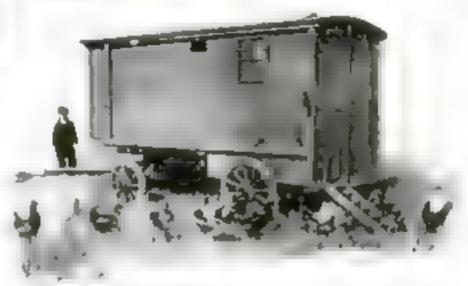
But now a substitute has been discovered. It is called "brilliant friction" and is being manufactured in Slovakia.

Perhaps this sounds indefinite and far away—but already great quantities of the composition have been exported to Sweden, Denmark, Holland, Austria, and Germany.

# Keeping Hens on the Move

WHAT exciting lives German here must lead! Throughout the harvest-time they never know, on going to roost at night, where they will be in the morning. Why' Because they hive in traveling hen-houses. Each night, when the hera have turned in, the hen-house is carted to a near-by field from which the grain has recently been harvested. Next morning the door is opened and a ladder attached. The hera hop down and feed all day on the waste grain that was left on the ground.

This method of feeding chickens is both simple and cheap; and the chickens greatly approve of it, since they can est all day long.



instead of taking feed to the chickens, the Germans take their chickens to the feed, the hen house is wheeled to fields from which the grain has recently been harvested.

# Dial Indicates Inaccuracy in Lathe

TRUING of work in a lathe and finding out whether the centers of the lathe are in alinement is made easy and certain by a new indicator-wave.

The gage is simplicity itself. It has only four parts, which are a Z-shaped rod, a long pointer, a plate carrying an indicating scale, and a small metalic body having on one side a recem to receive the dead center of the lathe and on the other side a centering point adapted to anter the center recess in the work

The work is placed in the chuck of the lathe, and the truing-gage is inserted between the work and the dead center. The lathe is then started up, slowly.

If the work is set up true the indicator will remain stationary, but if there is the least inaccuracy it will cause an eccentric movement which is magnified down the length of the indicator-rod. This magnified eccentric movement is plainly discernible and the exact extent of the inaccuracy is indicated on the scale.

The use of the gage is not limited to the truing up of the center mark of work to be bored, but it may also be used for testing the truth of the center of a lathe spindle, for truing up the face of work, and for setting the tailstock in accurate almement with the headstock.



In the illustration the scale is supported by an ordinary machinist's surface gage, but, as shown at the right, the scale may be clamped to a stationary part of the lathe



# Cranking the Airplane

#### It is an awkward moment that science has heretofore neglected

"I OW like a bird!" you murmur soulfully as you watch an airplane glide swiftly through the nir. But if you naw the ugly, mechanical way in which its motor was started back there on the field, you'd change your tune to "How like a flivver!" For the airplane's motor is cranked; and this cranking is no easy flivverish job wither, since the dangerous sharp-edged propeller is right on the spot all the time.

How is it cranked? One clumsy method is shown in the picture at the top of the page. An automobile motor is released from driving the wheels and is connected by a chain drive with a shaft that terminates in the propeller hub. When the motor of the automobile turns over so does the propeller.

Even this clumsy method is a distinct improvement over the earlier one in which the propeller was turned by hand. That was so "mechanically in-

decent"!

The pilot and passenger were, in a

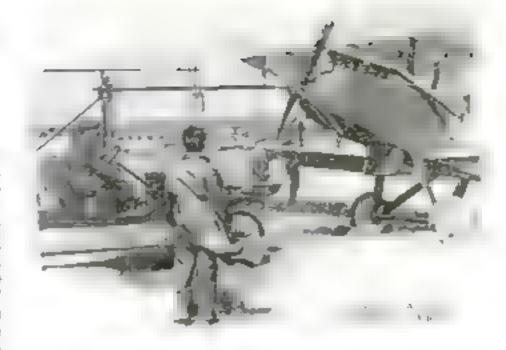
way, as passive as children in a baby carrage; It was the "gang" that "shoved them into space"-the crowd of mechanics that first took hold of the at ass both wings, and especially that damag may actor who started the motor by tackling the deadly proper car a note. I he sharp be or gave it a twist, and jumped back in time to save harself from being chopped up-

A propeller is shaped the very reverse of a crank, having a sharp edge exactly where there should be a handle. The moment the motor starts, it becomes necessarily as dangerous as a striking aerpent.

"Why not use a self-starter?" you ask. Its weight while the airplane is in flight greatly hampers the airplane's power. However, a de-

tachable starter invented by M. Other, a Frenchman, is now being used on many French simplanes. It is mounted on a bipod, and can be worked by one man.

A tube filled with liquefied carbonic acid is attached by a metal pipe to a long steel cylinder containing a piston. These are located on the longer leg of the bipod. A pulley is fastened to the piston, and over it stretches

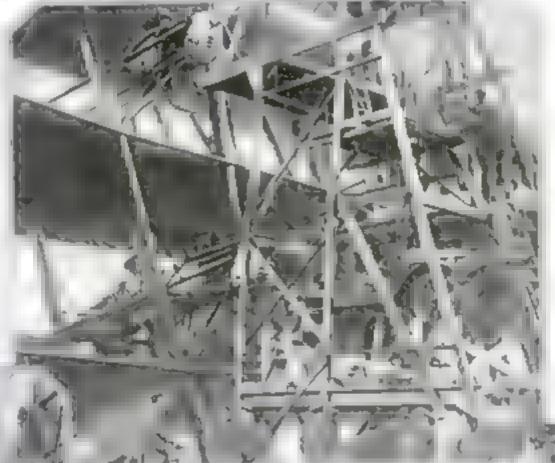


automobile motor is connected by a chain drive with a shaft that terminates in the propeller hub, when the motor is started the propeller turns over

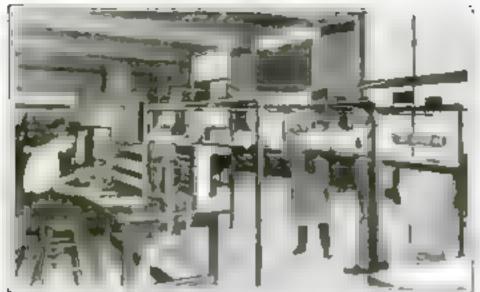
a cable that comes from the cylinder. The cable travels on, and is wound four times around a grooved drum, being fastened then to an elastic cord. The drum is mounted on a shaft together with a bell-shaped projection that is made to fit into the hub of the airplane propeller. Four bolts on this hell-shaped projection slide into grooves in the hub. To start the engine, a man presses a

lever that releases the carbonic acid. The piston then shoots out, and with it goes the pulley. The cable gives the dram a twist out over.

Now that the engage is started, how is the started, how is the starter or detached? You remember the boits on the latter part of projects in and the propess are cut at such an angle that the bots are forced out when the propeller white. Then all the attendan has to do is to earry the property of the propess of the prope



A Frenchman invented the detochoble airplane started a the right. It is operated by the release of carboruc acid against a piston, which whirls a dram connected with it has a cable. The dram a mounted on a shaft, together with a bell-shaped projection that lits into the hub of the propeller, as shown on the left When the dram whirls around, so does the propeller.



Copyright Witte World Physics

These men are making experiments for the purpose of determining the heat-saving value of pipe covering compositions

## Heat Saved Is Money Saved

WHAT are these men doing with this complicated apparatus that ranges all the way from a vacuum flasic to pipe covering?

The proceduring explains it. It is assembled for the purpose of measuring the efficiency of different pipe-covering compositions, and a used by the students at the Massachusetts Institute of Technology

The embryo engineers make their own readings and calculations, and much interesting data has been gathered. Among other things, it has been found that, by using a standard covering, a saving of \$1,500 a year is made on 1,000 aquare feet of 1 ½-inch pipe surface, when the inside temperature of the pipe is 400° F, and coal is ten dollars a ton.

# One Way to Keep Straight

CLANG! You jump with surprise as the bell sounds, for it seems to come directly from the chest of the man you are talking to. As a matter of fact, you discover that it does.

He is wearing what is known as the incorrectposition indicator, and every time his chest caves in a bell sounds, warning him to throw his chest out again.

The indicator was invented by George T. Boylan, of Hartford, Conn. It is made like a barness, having a belt

that fits around the chest, and a pair of shoulder-strape. A long flat case attached to the ends of the belt

contain the bell and the wherewiths, to ring it. One end of the belt is fastened securely to the case, but the other end is attached by springs. Thus, when you cave in, the springs contract. A lever attached to the sliding end of the belt moves back and forward as the springs contract and extend. This causes a geared wheel to turn. The wheel meshes with a second wheel, and this also, in consequence, turns. A contact point connected with the battery is mounted on the second wheel and is located—when the wearer stands properly—midway between arms of a metal fork which is also connected to the battery. These two contacts—the point and a leg of the fork—must touch before the bell will ring.

# Steel Legs for the Work-Bench

A GOOD work-bench is necessary for good workmanship; it must be light and strong and rigid and altogether carefully planned if it is to give first-class service.

Such a work-bench is shown below. The legs are made of U-shaped pressed steel, and have wide base-plates that are screwed to the floor. Even when they are stationed as much as eight feet apart they will yet hold the table in a perfectly rigid position



The U shaped legs of pressed steel have base plates that screw to the floor

The wooden table-top is attached to a metal frame that is electrically welded to the legs. The front balf of the table-top is of double thickness, and the back balf is finished off with a vertical board to keep the tools from allpoing off

The work-bench can be made to almost any length that may be required. It may run down the entire length of the work-room. A drawer for holding tools is located in a central position between each pair of legs, which, by the way, are made more firm by a strong metal bar running from each front leg to the back leg corresponding to it.

Since the screws in

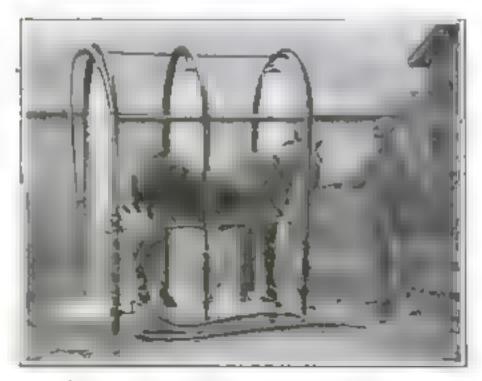
the base plates are the only means by which the work-bench is made stationary, you can readily see the ease with which it can be moved.

# A Mule's Daily Bath

THIS mule gets a daily shower-both, and so do all her saters who work with her in the mine,

The shower is equipped with three large nozzles that shoot a continuous apray of water down on the mule's head, body, and tool. Perforated pipes along the sides of the shower bath help to clean the day's accumulation of dirt from the mule's tired body.

Thus daily cleansing of the mule undoubtedly adds to her days of usefulness.



This mule works in the mines every night the is given a shower both, and this keeps her good-natured

Every time his chest caves in a

bell rings the bell

is operated by the

barness he wears

## Through the Breakers on a Surf-Boat that Can't Sink



Four men and a boy all grinning. It's no wonder each has a suri boat made of balas wood which is the lightest wood in the world, and they can ride through the breakers without unling as long as they bold on light

## A Monster Movie Screen

ADVERTISING by Iboards and moving-picture screens grow larger and larger. Which of the two is the monster shown here? Since it's outdoors, one would naturally call it a biliboard, but it proves to be a moving-

picture screen, one bundred feet square the largest in the world.

It was erected on the fair grounds at Columbus, Ohio, for the Methodist Centenary and cost more than eight thousand dollars. One hundred thousand square feet of lumber was used in the frame, and the screen itself is made of matched, smoothly planed boards painted white.

The pictures are thrown on this screen by nine projectors from a distance of one hundred and thirty-five feet, and one hundred and ten thousand people can see it.

Imagine a close-up of Mary Pickford on a screen like this, her face would be about fifty feet wide and each eyelash would be nearly a foot long!

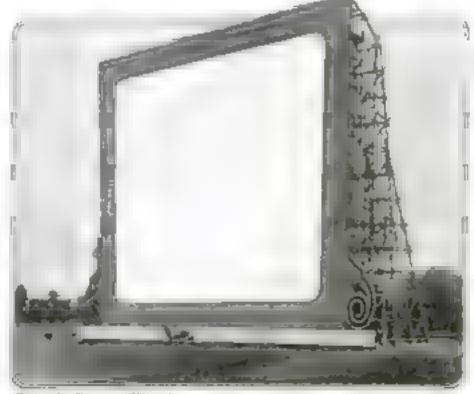
## Wood and Heat

WHEN you stop to think of it, isn't the most popular kettle cover in your kitchen the one that has a wooden knob on the top? No matter how hot the tin or agate or aluminum may get, you can aways lift it off by the wooden

knob without burning your fingers. This is because heat passes through wood much more slowly than it does through metal, and that is why wood is used so generally for handles of all kinds. Its low conductivity also explains its use for refrigerators and fireless cookers.

Woods differ among themselves as heat-conductors. Heavy woods, like one, conduct heat more rapidly than do light woods, such as spruce, and all woods conduct from two to three times as much heat with the grain as across it.

Stone and concrete conduct heat from ten to thirty times as fast as wood, and that is one reason why wood is more desirable for floors and walls.



Copyright Regulater View Co.

This moving-picture execu is supposed to be the largest in the world, it is one bundred feet aquare

## The Motor that Rocks the Cradle

# Rock-A-BY, haby, on the tree top, when the wind blows the cradle will

"ROCK-A-BY, haby, on the tree top, when the wind blows the cradle will rock"—uncertain rhyme and an ancertain way of putting the haby to sleep, the wind may not blow.

Luther P. Jones, of Russelville, Ala., has invented a cradle that will swin: constantly, regularly, and automatically, needing neither wind nor hand to rock it. A motor does the work. You wind up the spring when you want to start it. The motor turns a wheel that causes the bar supporting the cradle to awing. In the words of the patent paper, "the clock mechanism has an escapement connected with and

The cradle hangs on chains that terminate in the bar leading down from the motor and

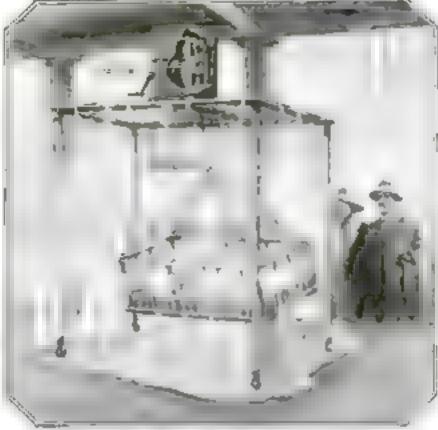
adapted to actuate the oscilla-

its attachment above. Thus, you see, if the baby should not care for sleep he will be interested in the wheels above and will forget to cry

In the picture above one pair of parents are about to desert their sleeping child for a moving-picture show. They have wound up the spring, and the cradle is going strong

If you do not think a motor and wheels are dainty enough to be seen on your baby's cradle, you can easily make a cover for them out of a lattle cretonne. Or do you disapprove of cradie-rocking?

Perhaps you believe that cry inglisgood lung exercise for babies.



Don't waste time rocking your haby's crudlet let a motor rock it for you. When baby wakes he can watch the wheels go round



This magnetic pullry is thade to carry a thin steel belt which makes great speed possible

# Soap and Brush in One

WHERE'S my shaving somp?" you ask." Baby's fed it to the cat," you are told. If the soap and brush were one there would be no chance of losing one half without the other, and lathering would become much simpler. Below **you see a shaving-brush having** a bollow handle, so that a stick of soap cuts be passed through it to a point within the bristles. A pusher attached to the cap forces the soap along the interior of the handle. If desired, the cap can be threaded, in which case it is turned to adjust the soup.



#### Play Solos and Accompany Yourself

If you strum a guitar, or tinkle a mandolin, either learnedly from music, or irresponsibly by ear, you have probably tried to play a harmony on the bass strings, while carrying the air on the treble strings. After apraining two fingers and tying the rest in knots, you have given it up in despair.

Elmer S. Tanquary, of Lawrenceville, I.I. has perfected a device that will finger the bass strings of a guitar, or other instrument, for an

accompaniment, while the accompaniment, while the sir is played in the ordinary way. The accessory clamps on to the neck of the instrument, and is worked with a rod attached to the little finger of the right band. It is a small trianguar block, with bars underneath, so a rranged that they

the bass strings at the proper frets to make sumple chords.

It is equally applicable to other string instruments besides the guitar.

# One-Inch Belt Carries 1,000 Horsepower

MAGNETIC pulleys in themselves are not new, but the older types carried a heavy laminated bett, while the one pictured above carries a light, single-thickness band

The new pulsey is made with a pair of close spiral grooves, technically known as helical grooves, which run parallel to each other around its circumference. In each of these grooves is wound wire to form an electromagnetic circuit. Current, fed through "shippings" at the hub, is passed through the two cods. It passes through one in one direction, and through the other in the opposite direction. In this way what is called a magnetic field is created, the two poles of the magnet being the two parallel helical grooves.

By making the magnetic field practically cover the surface of the pulley, great attractive force is obtained. In consequence it is possible to use a very thin steel belt, which is made in one piece or brazed together. The belt should not exceed .06 of the diameter of the pulley.

The steel best and magnetic pulley combination has tremendous driving power and will run at great speed. With a pulley fifty inches in diameter, running at eight hundred revolutions a minute, a one-inch belt will transmit one thousand horsepower

Steel belts may be safely run at a speed of eighteen thousand feet a minute. They are consequently useful for transmitting power from turbines.

84

By using the mechan-

scal fingering device

you can do without the

friend with a ukelele

# Fighting Flaming Oil with Foam

MASS of twisted sheet-iron and pipes from which rivilets of oil, gasoline, and naphths continue to burn is all that remains of the great oil plant. The blase gave the fire department the hardest twenty-five-hour fight in its history, but there is no longer danger of the flames spreading, as all the damage that could be done has been accomplished. The loss is estimated at \$1,500,000."

That is the report of one New York newspaper, written on the fourth day of the great oil fire in Brooklyn last autumn. The firemen had to fight the blaze with water and sand. These were inadequate for the purpose, and the only thing to do was to let the fire burn itself out, at a tremendous loss.

#### Non-Inflammable Bubbles

Chief among oil-fire quenchers is suffocation by foam. The great non-inflammable bubbles are poured over the surface of the oil, and the fire quickly subsides. The bubbles are made by combining sulphuric acid with blearbonate of soda. Carbonic-acid gas is thus formed, and it quickly suffocates the flame. Many oil-storage blants are now equipped with these bubble tanks, and some of the tanks work automatically. Thus, should a fire start when no one is near, the tank will see that it is put out—perhaps before any one arrives.

A large oil-storage tank was being built at Midland, Pa. The first ring, about five feet high, had been erected on the foundation, when the owners suddenly decided to try out their new automatic extingulaber. They poured two feet of water in the ring then eighty barrels of crude oil, and on top one hundred gallons of gasoline. They somed some cotton waste in kerosene, set it on fire, and threw it into the tank.

The fiames burst forth, and two minutes later the form began to flow. Two minutes nore, and the fire was out!

#### Foam-Piper Solve Problem

The pictures of this fire test show the two standpipes, one on each aide of the tank. Both of them contain the foam-making liquids. The one on the right was used for this particular fire. Bicurbonate of sods and soapbark dissolved in water are kept in the bottom of the pipe. An acid-tank for the sulphuric acid is mounted above the level of the sods solution. A pipe leads down from the tank to the solution below

At the place where the acid-tank and the pipe meet there is a glass plate to keep the acid from rushing down the pipe under normal conditions. A planger is mounted directly over the glass, and above the planger there is a hummer, held in place by chains which have links that will melt when heated to 212° F. Thus when the fire was started the links melted, the hammer dropped on the planger, the planger broke through the glass, the acid ran down the pipe, mixed with the sods—and the loam came bubbling out of the spout of the stand-pipe.

There are many other ways in which foam-pipes may be made to work automatically. In one instance, the valves that let loose the liquids were worked by electricity; the heat melted a fusible connection that started the current.



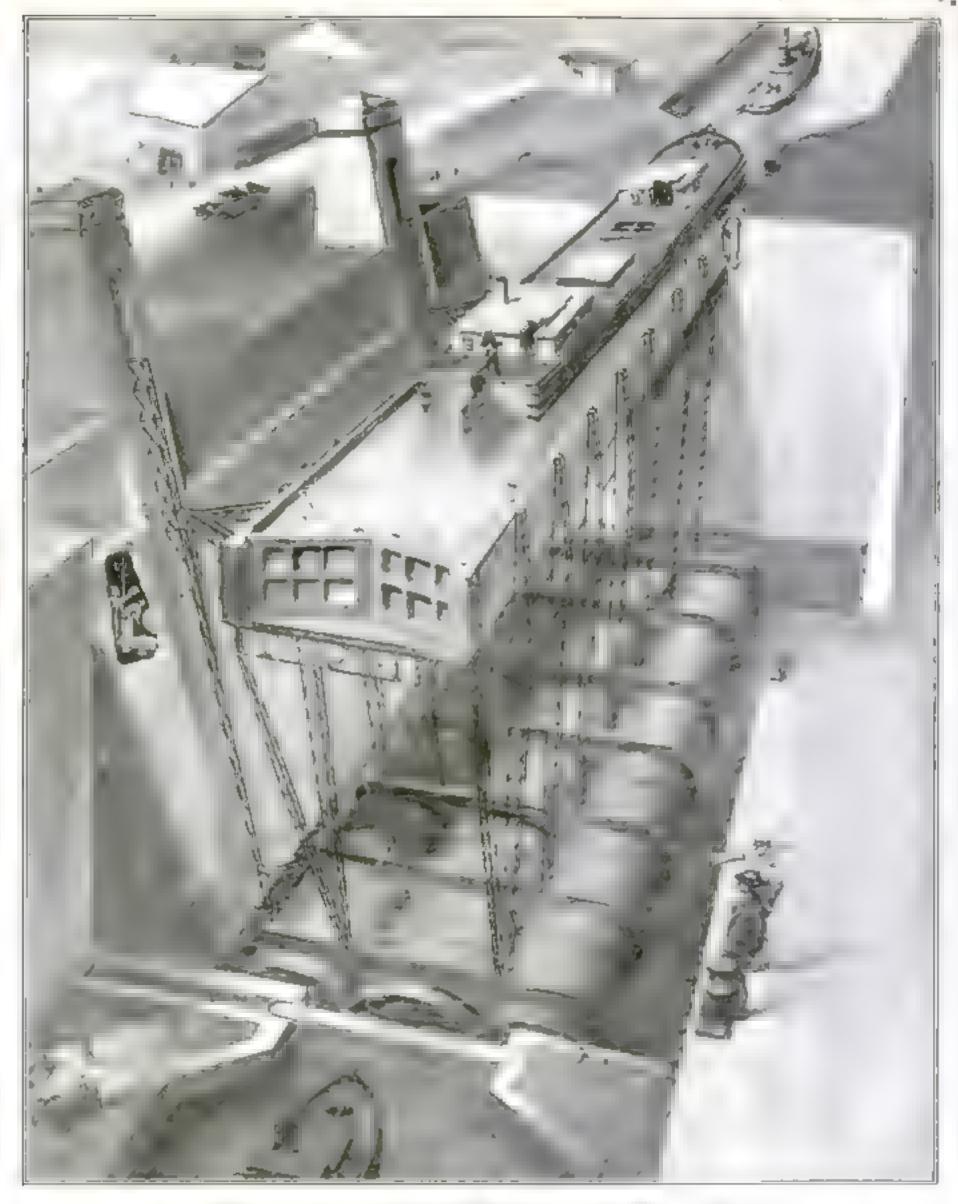
To test a new automatic oil-fire extinguisher, flaming outton waste was deliberately thrown into this tank when the heat of the fire reached the pipe at the right, things began to happen



The pipe contains two tanks, one holding blearbonate of sods and the other holding sulphuric acid, when these are mixed a foam results that contains curbonic-acid gas. This gas suffocates the dames



Two minutes after the form started to flow over the burning oil the fire was out. Since the form method has proved to be so successful it is being installed in many oil plants.



# A New Lock that Saves Water in the Upper River

The lock shown in this picture is the invention of a German engineer and seems to solve the problem of overcoming great differences of level in river pavigation at a man main of cost and without drawing the river on the higher

level of too much of its water. The water fixed tank which hads the mid and the en a steel strate supporting it are that a horse which relieve the burden on the housing much nery

# A Lock that Does Not Waste Water

It combines the principles of the ship railway with those of the basin lock By Ernest Welleck

WHEN two navigable rivers are to be connected by a ship-caust, one end of which is considerably higher than the other, locks must be constructed between the two rivers. Otherwise the river on the higher level would lose a great amount of water which would flow through the connecting canal into the lower river

If the locks are used frequently, the consumption of water may seriously impoverish the volume of water in the higher river. It is true the water necessary for operating the locks may be taken from the river on the lower level and pumped to the locks. This would not interfere with the navigability of the lower river, as the water taken from it would be returned to it after having been used in the locks. But the pumping of water, especially to a much higher level, is very costly and consumes a great deal of time.

#### Ship Railway and Basin Lock

A Corman engineer has invented a method of overcoming all these difficulties by a combination of ship railway and basin lock. The ships passing through the lock are carried in a waterfilled tank of reinforced concrete resting upon a substructure of latticed steel which constitutes the truck frame of the carriage. The entire structure does not, however, rest upon wheels running on an inclined track as in the case

of the ordinary ship railway, but on three targe and air-tight cylinders of remiorced concrete. When fully submerged these cylinders support not only their own weight but also the weight of the steel carriage and of the water-filled tank.

The lock basin, wider at the top than at the bottom, forms a trough lined with reinforced concrete and is inclined on the side on which the housting and lowering machinery is located.

Let us suppose that a ship is to be lifted from the lower to the upper river level. The car, with its steel structure and the water-filled tank resting on the air-filled concrete cylinders, is ready at the water-gate. The water in the tank is on the same level as that in the lower river. The entire weight of the carriage is buoyed up by the cylinders, and there is practically no weight on the wheels or rollers, which are resting on the track of the ship railway. The sliding water-gate is opened and the ship is admitted to the tank.

#### Supported by Air-Tight Cylinders

After the gate has been closed, the propelling mechanism, driven by steam engines or electric motors, is started, and the carriage, now with the extra load of the ship in the tank, begins its voyage toward the other end of the lock.

Since the level of the water in the lock

in the same in all parts of the lock, while the carriage moving on the inclined plane of the track is steadily emerging more and more, it is clear that the burden upon wheels, track, and engines increases gradually as the carriage moves toward the upper river end of the lock. Yet, the greatest burden that is likely to be imposed on the moving mechanism under the most unfavorable conditions is estimated at a trifle more than one bundred tons, the rest of the burden is supported by the buoyancy of the air-tight cylinders.

#### Through in Twenty Minutes

When the carriage reaches the upper river end of the lock, only the cylinders are submerged. The tank is high above the water in the lock, and its water is on the same level as that in the the upper river. The sliding gate is opened and the ship passes from the tank into the waters of the upper river. It is calculated that the average time required to carry a twelve hundred-ton ship through the lock will be about twenty minutes, assuming that the difference between the upper and the lower river levels is not less than thirty and not more than seventyfive feet. The cost of constructing a lock of this kind is considerably smaller than that of an ordinary lifting

### It Does Five Machines' Work

If by scrapping five machines and buying one you could asve space worth hundreds of dollars, would you do it? Space is valuable. A recent article in the Popular Science Monthly estimated the cost of the space for two ordinary desks in New York (a space covering some fifty

by mixty-four (nches), as thirteen thousand dollars.

A Chicago manufacturer has recently perfected a markine that takes the place of five others. It embodies in itself convenience for shearing plates and round and square bars, coping and notching, section cutting, and punching, without the necessity of change

Several operators may use the machine at the same time without getting in one another's way, for the various operations are completely independent of one another. The control of the machine is by foot levers, through gears and clutches.

ing any tools or attachments.

Work of practically any size can be manipulated, for the girders, bars, etc., are not impeded in their passage through the machine.

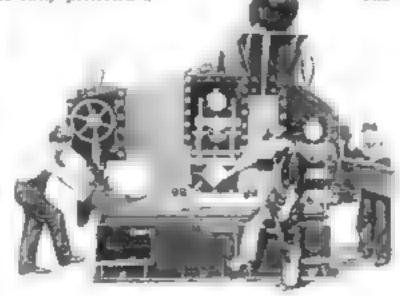
# Sea-Grown Insulating Fiber

MATTED beds of fiber, seven feet thick it some places and several square miles in extent, have recently been discovered on the seashore of South Australia in

the region of Posidonia. This is a valuable find, for the fiber is excellent material for insulating steam-pipes and refrigerator plants. The beds are formed from the withered stalks of a plant which is not a

stalks of a plant which is not a seaweed, but which resembles rather a flowering land plant except for its habit of growing under water. Its withered strawshaped leaves wrap themselves around the stem and after a time form a dense matted bed of fiber on the bottom of the ocean, which here is shallow. From this bed a new growth of fiber springs, withers, and in turn becomes the ground for another growth, so that the bed grows constantly thicker.

It is estimated that the whole deposit contains 4,500,000 tons dry weight, and the South Australian government foresees from its exploitation a rich new industry.



When one machine can do the work of five, floor space can be laid out with greater economy. These three menare using the machine for three different operations



The post, with the guy-ropes attached is on its way across the forty foot space to its new location

#### Moving Poles without Disturbing Wires

POLES carrying 68,000-volt wires, 2,300-volt wires, and telephone wires, followed a country road. The course of the road was changed, and the poles had to follow.

The pole to be shifted was supported with guy-ropes at right angles to the line of posts, and a pole-jack was used to uprout it. A two-ton motor-truck then appeared on the scene, and the eixty-five foot pole was secured to its rear end. The truck, with its unwieldy burden awaying and trembling, backed slowly up to the new post-hole forty feet away. The linemen rapidly cast off the lashings and lowered the pole into its new home.

It was found possible to move all the poles in this way without untying the lines at any point.

#### When Mother Earth Tips the Scales

THE earth weight 6,900,000,000,000,000,000,000,000,000 tons. Can you pronounce it? We suspect that Professor Louis E. Dorr, head of the department of physics at the Massachusetts Institute of Technology, who weighed the patient, speaks of it lightly as "six and twenty-one ciphers tons."

The weighing was an elaborate process. First, two small spheres were weighed with the finest accuracy and freely suspended from the end of a short rod by threads made of quartz one twelfth as thick as a human hair.

Next, two lead balts weighing about ten pounds each were brought into the proximity of the suspended balls, and the influence of their superior mass immediately changed the position of the smaller balls. The force that did

# Eat by the Light of Your Lunch Pail

UNCH pails mean lunch-time, - the light is located directly under the and lunch-time means noon to handle of the pail. Beneuth the torch, the

most of us; but not to Clarence M. O'Neel of Eagle Creek, Ore. He eats his lunch at night—or at least the lunch pail that he has recently invented would seem to indicate that he does.

The unusual feature of Mr. O'Neel's lunch pail is that it is equipped with an electric torch to see what he is eating.

At first glance the pail looks like an ordinary natchel, but you soon notice that the opening is at the bottom, and that one end of the top is separated from the main body of the pail and wears a cap.

Underneath the cap you will find the lens of the torch. The cap is used to protect the lens when it is not in action.

The switch that controls



pail is divided into two sections, the upper one holds a vacuum bottle, and the lower one the lunch. The bottle has two uses—it will hold coffee, and will serve as a hat-rack for the cap when the cap is taken off the lens.



For those who cat their lunch at night this lunch pail has been invented. It is provided with an electric torch, so that one may see what he is eating

## Iron Roses Fresh from the Anvil



This scrith, a mighty man is he. He hazaners out not horseshors but roses

this was calculated to be equal to the weight of a human hair one hundred thousandth of an inch in length.

Knowing the weight of both sets of balls, and having determined the force that the lead balls exercised on the suspended ones, also knowing the power of the earth's attraction upon the lead balls, which is their weight, the final calculation of the weight of the earth became simply a problem in proportion.

WHERE are the blacksmiths of yesterday? Still hammering, most likely; but few of them are working on horseshoes. For example, James Cran, of New York, hammers iron into roses and sells them to an admiring public. Below you see a bouquet of fron roses tied with an iron ribhon. One leaf is abnormally large, to act an a card-tray

When a flower is made, the different parts—petals, leaves, and caly acc—are forged separately. The veins, ribs, and rough edges are made by the peen of the hammer. Mr Crancan make a spray of leaves in half an hour, but it takes him at least two hours to reproduce a rose, with all its fine, interluced petals.

Other flowers he makes as well. Once he hummered out a Scotch thistle for Andrew Carnegle. Both men were born in Scotland.



This elaborate card-tray of roses, leaves, and ribbons is made of iron, hammered out by a blacksmith

# Getting Ready for the Winter Hike

By Charles Coleman Stoddard

HAPPILY the day is past when most of us feel that winter is a shut-in season, that the open air means colds, tonsiliatis, or pusumonia. With proper clothing and equipment, we may even stay out overnight, or plan a protracted camping trip. Perhaps even as you read this page the snow is falling. You are fortunate if tomorrow is a holiday; for that may mean a long hike along the drifted

roads and across the snow-covered fields. If you are in camp, nothing gives the same thrill as to wake in the morning and find that silently through the night the cold hand of winter has spread a white carpet throughout the wide world.

Imagine setting out in early morning for a long bike across a boundless landscape of unspoiled, unbroken snow. It makes the blood leap even to think of it. There is no need for roads, even the hillside path has lost its familiar aspect. Our way leads us across fields, over frozen brooks, through the now open woods,

the winter view is so wide we are amazed at the way the world has shrunk; we attempt short-cuts we would never dream of in summer when we would be certain to be mired in swamps or lost in the thick forage of the underbrush. Whether we walk for the sheer joy of motion, or whether our quest leads us to the study of winter birds, or to the intimate observation of the mysterious and fascinating tracks of animals that cross our path from every hand, we are sure to be rewarded a thousand times over. The keen ear quickens the blood and brings color to the faded cheek, calls back the lost health and induscriminate hunger of youth.

#### The Two Dor'ts

The two most important cautions for winter hiking are not to overdo—not to walk too far nor too fast, nor to pack too heavy a load; and not to wear too much clothing—save most of it to slip on when resting or loafing about camp.

The invigorating air and the joy of facing nature in her most boisterous moods offer a strong temptation to go to the limit of endurance; but it is a mutake to overtax oneself unnecessarily, especially in winter. Anything

that tends to exhaustion lowers the resistance of the body to cold. Therefore, measure your stride and your distance carefully, and always aim to come into camp in ample time to make all preparations for the night, to have the bed ready, an abundant supply of firewood, and the evening meal out of the way before dark. Eat regularly, even on the road, it is well to have a luncheon in the pocket—a sandwich,

or bread and peanut butter, or chocolate. The out-door life, partleularly in cold weather, increases the appetite immensely, and any physical depression, from hunger or any other cause. must be esrefully guarded against. You may pride yourself on being able to pack all day in the summer on an empty stomach; but remember that heat, bodily comfort. and the ability to resist cold, all come from the inside, and that the firm of the body burn out more rapidly with the frost and osone of winter days.

Overheating the body through hard

exercise, with the consequent sudden chilling, is infinitely more dangerous in winter than in summer. One always must be prepared for the halt and for a sudden drop in temperature.



Two light-weight garments are always warmer than a single garment of their combined weight and of the same material. For the same reason, a loosely woven garment is warmer than a closely woven one, because of the dead-air it contains. Rubber, leather or other waterproof garments should not be worn while exercising.

as they induce perspiration and do not permit it to pass gradually away from the body. A loose garment of khaki, canvas, or other closely woven materral (not waterproofed) may be worn as an outer garment to shed show or rain or to prevent too rapid dissipation of beat in the wind.

but cotton, lines and silk retain moisture much longer than wool and become cold and elammy, and should not be worn in win ter except as some auch outer garment.

Loosely wov-

ments, of moderate weight, are the best for all occasions on the road. One or two suits of medium-weight woolen underwear, a good flannel shirt, woolen trousers, light woolen socks and a heavy pair of woolen stockings pulled on over these and drawn up over the legs of the trousers, and strong, waterproof footgear, is the most satisfactory outfit and about all one will care to wear while in action even in temperatures far below freezing. The extra clothing goes into the packsack.

Two light weight gar-

ments are always warm-

or than a single one of

their combined weight



Clothing for women should be of the same materials as that for men and the nearer it approaches the latter in the cut of the garments the greater will be the comfort of the wearer. Long or tight skirts should never be worn into the woods and under winter conditions make proper walking impossible.

A good sweater is a great comfort, particularly if made in the coat style with a high rolling collar. Those with a long, loosely napped finish hold a larger amount of air and are consequently much warmer. Or you may prefer the popular "stag" or "cruiser' shirt, of twenty or twenty-six ounce mackinaw, which can be worn either inside the trousers or allowed to fad outside like a coat. The new "beach cloth" garments are practicable and reasonable in price. This material is fleece-lined, with a tightly woven, windproof outer fabric, and worn over



Some of the most gongeous summers are found at this time of the year



You can make yourself comfortable by the method shown in the above illustration. The fire is essential in cold weather

woolens is certainly warm. The mackinaw or other outer coat should have a broad belt all the way round, to close the air space and to hold it snugly to the body in the wind. But it is important to avoid all constriction in the clothing, belt, garters, shoes or mittens. Anything "tight" to the feeling is interfering with the circulation of the blood, and the part cut off is certain to be co.d if not to freeze.

Unless you plan for anowshoeing, crumers or heavy, oiled high shoes are better than moccasins for hiking. If the latter are used, oil-tunned ones are best when the going is likely to be at all wet. Ordinary rubber and cloth arctics, worn with insoles and heavy socks are also practical, and may be used with the snowshoes. Have the shoes soft and comfortable, with strong soles, but not so beavy as to be a burden, and large enough to permit wearing two or three pairs of heavy stockings in very cold weather. When a less number are worn, take up the apace with cork or hair Insoles to avoid friction and chafing the feet.

#### Remember Your Hands

Mittens are warmer than gloves, as they do not constrict the fingers nor divide the dead-air space. They are now made with a separate forefinger as wel as a thumb, which enables one to handle small objects without exposing the hands. A good plan is to have a larger and outer pair attached to the ends of a long elastic band passing over the shoulders and through the sleeves of the cost.

You will want a good, warm cap that can be drawn anugly down over the ears. A fur cap may appeal to you, and is a luxury, but any one of the many woolen caps is equally satisfactory—and perhaps even more so, unless you are in the far north or the weather is extremely cold. You will find your sleeping beimet comfortable on a very cold day. It protects the face and neck, as well as the ears. The cap should always have a visor, to shut out the glare of the sky.

If the days are bright, the reflected light from the snow will also prove an annoyance, and even a danger if long continued. A pair of rubber-framed automobile goggles, with the glasses only slightly colored or smoked, will be found very rest'ul, as they also shut out the troublesome reflections from the side. Spectacles are always more comfortable than eyeglasses in the woods or in the wind, but in cold weather care should be taken that no metal parts touch the skin. The bridge and the bows should be cork or rubber covered, or they may be wound with woolen yarn. They may be worn under the goggles.

#### Lost in the Snow

Before setting out on a winter hike, even when reasonably familiar with the country, it is well to study the maps carefully, and to carry them

where they can be consulted frequently without digging too deeply into the clothing. The absence of foliage and the heavy snowfall change the landscape so completely that the most familiar landmarks seem strange. And never, in winter, venture into the woods without a reliable compass and knowledge of how to use it. Of course, if lost, you may follow the back track in the spow, and sun and stars may guide you, if you can see them, but a sudden snow flurry may contuse all sense of direction, and in a drifting wind all tracks may be ob sterated

If you are hopelessly lost, do not attempt to go on until you are exhausted. Stop where you are and use your remaining strength to prepare for the night. Scoop out a trench down to the bare ground, and in one end of it build a small fire; about the other end, throw up a rough lean-to of brush, bark and boughs banked with snow, to protect yourself from the wind. A small fire is better than a large one, for you can crouch over it "Indian fashion" and keep warmer than by a large fire that will fry your face and freeze your back—a small

fire, too, will need more attention, occupy your time, and help to keep you awake. By all means, keep awake ' It will require some effort, but do not, under any circumstances, go to sleep. Such a bivouse in the snow is not dangerous, scarcely uncomfortable infact, I look back upon one or two minuter occasions with distinct pleasure. At daybreak, take up the tangled skein. You

will have rested, and collected your wits, and the chances are that it will not be long before you untangle it.

#### Mealtimo

While a luncheon of some sort is a necessity on a winter hike, if we make it a hot meal cooked in the anow-covered woods, we have a luxury never to be forgotten. It is wonderful how the most jaded appetite awakens after a few miles of winter walk, how the stomach calls for hot food. Then there is the romance of the glowing fire, the cheerful cracks and songs, the ruddy, healthy faces, and the satisfaction of having bested the Red Gods in their very lair. The menu need hot

be elaborate: a steaming kettle of tea with plenty of sugar, hot toasted bread with slices of bolled ham extra-broiled on a split atick over the fire, a can of beans or apaghetti, or a sizzling pan of bacon. Just empty the beans into the bot bacon and brown them, It will give them an extra flavor, and you will relish more fat, and more sugar, than you ever dreamed of, in the cold and in the open. A generous slice of homemade poundcake and a comfortable pipe - the gods themselves could not sak for

The outfit for such a meal is not a burden

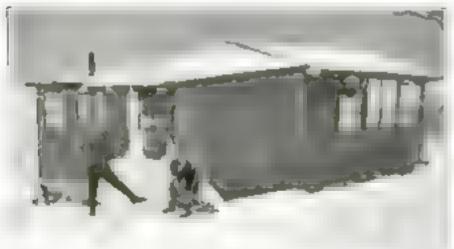
and amounts to nothing if there are several in the party. You need some sort of a packsack anyway, in which to carry your spare clothing when on the road

If you feel that you are not hardy enough to remain out all night, by all means try one evening meal in the snow, and tramp home after dark. The glow of the camp fire across the snow is never to be forgotten; the glory of the winter stars, that seem near enough almost to be within reach, the cold moonlight across the valley, the black files of cedars marching like an army across the hills.

I remember one such bivouse when all evening the snow was falling silently about us, heaping upon our caps, shoulders and backs until we seemed some queer, unearthly creatures of the frozen world. The treetrucks glowed warmly in the firelight and from far away came the low complaint of an owl. Then came the long march back through the deepening snow, when we remped and ming as children, until a single, far lighted window spoke to us of home, with dry clothes, a warm fire, apples and cookies, a dreamless sleep, and another joyous morrow in the open.



Tramping miles through the brush and mow sharpens the appetits to a keener edge



When the ducks are flying low it's an easy matter to step out of the shack and bring down a few for dinner



# Positive or Negative—Which is Which?

How to distinguish the poles of a battery when surface markings have been obliterated

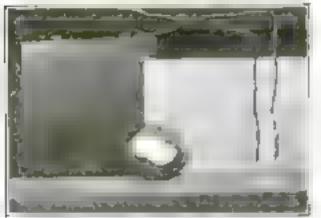
By Windsor Crowell

ET'S suppose that in front of you sits a storage battery. Its polarity markings are obliterated, yet the situation demands immediate action. Do you know how to determine the negative from the positive pole?

"Oh", you say, "I can test it out with my voltmeter or can tell by the

color of the battery plates."

That's fine—until you discover that your voltmeter is at home and that the battery casing is not transparent but is like a brick wall, and the plates are completely hidden from night.



Bubblet rise from both wires but a great many more come from the negative wire thus from the positive

Then you will have to admit that you are in a pretty fix and no mistake.

But-if you can discover a potato patch nearby-the day is saved. Just sneak over when Farmer Brown isn't looking and lift a good big spud from a hill. Shave off the skin from one side so a goodly portion of the mest is exposed and set it down alongside the battery. Then take a terminal wire in each hand and press their bared ends into the shaved section of the putato about an inch apart.

See that? The potato in contact with one of the wires commences to discolor until it finally shows up as a consplexous spot of green. What does it mean? Why, simply that this particular wire is attached to the positive pole of the battery. So that settles it. The other pole must be

the negative one.

But—suppose you happen to be in a desert, on a mountain side, or far from a potato patch or a grocery

store - what then?

Pour out a little of the electrolyte solution from the battery into a glass, place both wires in it, keeping them well apart, and watch the result, Bubbles will rise from both wires, but a great many more will come from the negative side than from the positive. This test is always sure.

Now, on the other hand, why not be prepared for this very emergency and carry an infallible test with you? It costs little and may come in mighty handy some day.

Buy a section of stout glass tubing (steam gage tubing is good), about 6 in.

Connect the two wires to the battery and stopper. Next

long. Next get two rubber stoppers to fit the tubing and force a common dry battery terms pal through each watch what bappens comes the solu-

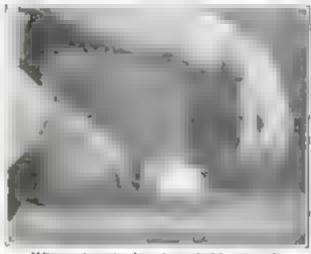
tion. As alkali always surrounds the negative pole such a presence can be ascertained by placing the negative wire in a neutral solution. This solution is made by dissolving about six grains of sodium sulphate in two ounces of water. Then add a few drops of phenol phthalein. Stop up one end of the tube, fill it nearly full of the polution and then push in the other stopper. Be sure the stoppers fit tight so leakage will not occur. Seal the end if the tube is to be carried about much.

In its normal state the solution will be colorless. But connect the two terminals to the battery wires, turn on the current and watch.

The phenol, which remained colorless in the neutral solution, will gradually assume a reddish purple hue about the negative pole and remain so sa long as the current is kept on and the liquid is undisturbed. When the current is disconnected, shake the tube and the color will disappear.

Paper soaked in the foregoing solution will show the same phenomenon, when a current is appared.

(f you are doubtful as to the polarity of the charging circuit, dip the ends

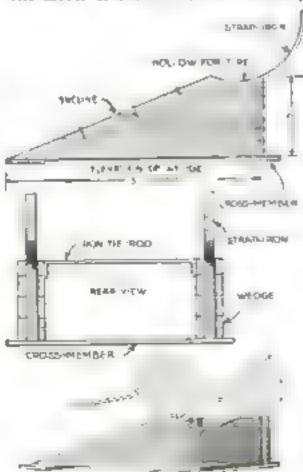


Where the wire has been held upon the potato a green spot will allow denotes the positive pole of the battery

of the charging wires into a beaker of water in which has been stirred a tempoonful of sait. Turn on the current and a discharge of fine bubbles will be seen to rise from the negative wire.

## How to Work Under

WHEN trouble occurs either with the under side of the automobile motor or the rear end of the car,



Run your cut up the incline and work beneath it with case. The contrivance is emily made and pays for itself in a short time

a Car Without a Pit it is somewhat inconvenient to work

without a pit. To partially overcome this condition a garage man built a sort of runway, as illustrated, by which the end of a car could be quickly elevated about two feet off the floor, thus allowing fairly easy access to the parts.

Two wedge shaped pieces were constructed of heavy apruce timber, 5 (t. long by 2 ft. high in the rear. The inclined ends of the timbers were fastened together by lag screws and the vertical backs secured to each other by a length of strap iron. The horizontal surface of the uppermost timber was hollowed out to receive the tire and the strap iron was continued outward in a corresponding curve which acted as a bumper to prevent the wheel running off the back of the

These two wedges were then holted together at the bottom with two cross members, as shown, so they were just the width of the tread of a car

The car can be run up this incline either by power or by hand and the necessary work done with a minimum amount of inconvenience and labor. Of course it is not necessary to mention that it saves the repairman's back and perven .- THORNTON HALLETT.



# An Idea, Our Good Name—and the G.T.M.

They had never used a Goodyear Belt. Their experience with the belting they had in their parent plant had been generally satisfactory. But the Fort Atkinson Canning Company did know Goodyear reputation for quality—knew it by the willing testimony and the demonstrated experience of other concerns the country over who were reporting notable successes with Goodyear Belts on every kind and condition of drive.

And the plant analysis idea proposed by the G.T M.
—Goodyest Technical Man—struck them as the logical way to insure the right belt for every duty. They had opportunity to test the principle of it thoroughly in a study of their new plant's belting requirements. They had the G.T M. make the study.

So they specified 100% Goodyear equipment transmission belts, conveyor belts, steam hose, water hose—for their new cannery at Jefferson, Wis, all on the basis of the G. T. M.'s plant analysis, and their confidence in Goodyear products.

The Jefferson plant is an efficient linking of different transmissions and conveyors. No one type helt, however well adapted to one form of duty, could be depended on to fulfill with equal capacity all these varied demands. An expert analysis that insured the full effectiveness of every drive in teletion to the entire unit appealed to the superintendent as the only right solution of the power problem.

Note the belts specified to their particular uses; for the light drives, where the conditions are small pulleys run at high speed and uniform load, Goodyear Glides; for general transmission and moderately heavy duty. Goodyear Kangtate has been used Width, plies and type are specified to the service required. The very natures of the Goodyear Belts employed meet the peculiarities of the situation. For instance, the belt on the canning conveyor, due to its particular construction of cover, fabric and friction, insures against the action of scids encountered in the raw material it carries.

The unfailing performance of these Goodyear Belta substantiates the plant analysis method of applying belta to the specific service. Their freedom from belt troubles—no slipping, no stretching to an appreciable amount, which usually causes an interruption in production in order to "cut out" and take up the slack—is their own best service assurance.

Both Goodyear analysis and Goodyear belts are at your service. The G. T. M.'s expert study of a single drive or a complete plant installation is without obligation on your part. For further information about the Goodyear plan of plant analysis and the G. T. M., write to the Mechanical Goods Dept. of the Goodyear Tire & Rubber Co., Akron, Ohio.

GOOD TEALS



# Hanes guarantees wear-service that exceeds your expectations!

You buy the greatest winter underwear value at the price in America when you put your money into Hanes! You can pay more for frills, but you can t get greater warmth or better workmanship or more actual wear than every Hanes garment must supply! Our guarantee backs thus statement to the limit!

You should know that Hanes Underweer—from long-staple raw cotton to the perfected Hanes garment—is made in the Hanes Plant! All of the multitude of details that make Hanes supreme at its price are under direct Hanes supervision!

#### Union Suits-Shirts and Drawers

Hanes is made in winter weight union suits and shirts and drawers, librarated on this page is the staunchest, most comfortable, wear-reserting union suit ever soid at the price. It is faultless in workmanship and gives a man everything he ever desired in underwear.

Hance Union Suits have the most desirable and dependable features—unbreakable seams; remforced buttomholes that last the life of the garment, tau or d collarate that cannot gap, shape holding elastic shoulders; elastic knit wrists and ankles; pearl buttom sewed on to stay. And, a closed crotch that stays closed!

Hanes Shirts and Drawers have the desirable quality, perfect workmanship and features that have made Hanes Union Suits nationally famous. Drawers that have the durable snug-fitting 3-button sateen waistband.

#### Hanes Boys Union Suits

in quality of material, cosy warmth and workmanship are unsurpassed at the price. Famous for durability. Reinforced at all buttonholes and strain points. In fact they duplicate Hanes Union Suits for men, with added fleeciness. Made in sizes from 2 to 15 years. Two to four year sizes have the drop seat. Four desirable colors.

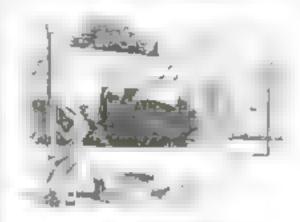
> Ask for Hanes at your dealers. If he cannot supply you, write to us direct at once.

#### P. H. HANES KNITTING CO., Wisston-Salem, N. C. Naw York Office

WARNING TO THE TRADE Any gargest offered to Hance in a substitute union it bears the "Hance label."

#### Pulleys on Posts Raise Wash Out of Way

WHEN there is a wash hanging on the back porch or in the yard, it is almost impossible for a person to pass without being slapped in the face by the wet clothes. The drawing shows a simple method of avoiding this discomfort. Two pulleys made of 8 in, wooden disks having bevelled



The elevated wash line isn't new by any means but it a a sure way of drying the wash quick y

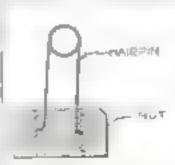
edges are bolted to each post used to support the wash line, one pulley at the top, and one about 3 ft. above the ground or floor. The bevelled adges of each disk are turned in when the pulley wheels are natled together, leaving a grooved edge.

A 15 in, rope is run over each pair of pulleys, the ends being apliced so that the rope fits the grooves of the pulleys tightly. The wash line is tied firmly to the pulley ropes on opposite poets, as shown in the sketch, so that when the pulley ropes are pulled up the wash line rises also.

By hanging the wash on the line when it is lowered, and then raising it, the whole wash is put up where it gets all the air, and where it is out of the way of anyone who wishes to walk under it. The posts should be from 12 to 14 ft. high to raise the wash the proper distance.—Horace Van Nice.

#### Using a Hairpin to Clean Machine Threads

A HAIRPIN is very useful in cleaning dirt and grit from screw threads of small diameter. It should



Another of the many nes for the common harpin is cleaning much the threads

first be bent into the shape indicated in the diagram so that the distance between the ends of the pin is slightly greater than the diameter of the threaded hole. Epring the ends of the pin together

until they will go into the hole, then screw in the hairpin. The bent ends will remove all the dirt and grease from the threads. In cleaning very small threads it may be necessary to sharpen the ends of the hairpin.

# United States SAND PAPER



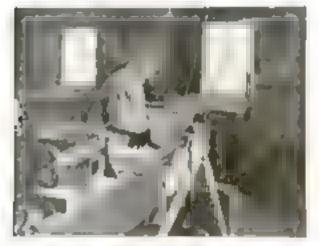
#### Fast-Cutting Mineral Abrasives

on Cloth and Paper

Garont Paper Cornet Cloth
Emery Paper Imery Cloth
Crocus Cloth
Carbalog Cloth
Hercelandom Cloth

Sheets, Discs, Cucker, Selte and Rolls of various widths and lengths of the above U.S. Abrasivas.

# for this automatic sandary machine are three drawn covered with survey with an and had been a formal force.





High speed endler that help at solid paper to be me a for an every representative and only against the high helps again house.



The old way of fracting threats of emery enterthings to workeful. It is Emery Cachalax and Heren-lands may concented with eds. the arts and more economical way. Some time.

# This map means dependable sand paper

SAND PAPER is NOT made with sand. Neither is all sand paper as a tool—a cutting tool—and is purchased with extreme care by all who demand the finest tools.

Sand paper, as made for many years by the United States Sand Paper Company, is fine white first or semi-precious gamet, crushed and sifted through silk screens to minutely exact finenesses—then everlastingly glued to tough fibred paper made especially for the purpose, or strong cloth. Every step of the process is constantly subjected to searching inspection—for dirt or a few over-sue grams in a fine polishing paper, for instance, would rum the work. The glue must grip each gram just so-each little grain must be comented to its neighbor just right—the flint or garnet grams must break and continually present fresh, sharp edges to the work. Exceptional quality that does not vary repays close attention to details like these.

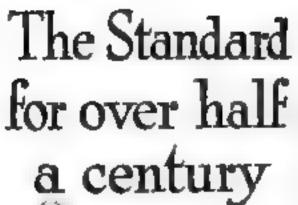
In the wood-working industry, U. S. Sand Paper is used on drums, discs and sanding machines—cachdoing a tremendous amount of work formerly done by hand. Above the workmen's benches hang rolls of U. S. Sand Paper in several convenient

widths and lengths—a wasteless, time-saving method of using sand paper.

For cutting metals, the tough, bard Herculundum and Carbalox from the fiery electric furnace are the modern fast-cutting artificial abresives. Herculundum for cast fron and similar materials; Carbelow for steel, brass, copper, aluminum, etc. Discs of Herculundum cloth glued to wheels are taking an amasing amount of work from the planer and milling machine-and saving much time and money. We would welcome an opportunity to discum thus in detail with you. For machinista, we furnish Herculundum and Carbalox in convenient rolls. You can tear off from one of the rolls a piece of the exact width and length needed to do the work economically.

Buy U S. Sand Paper scientifically—the right grade for each class of work. Our Service Department will help you determine if we have a grade of abrasiva paper or cloth that will reduce your sanding costs—or t. In out your metal, leather or composition products at less finishing cost. It costs nothing to get this information. Ever afterwards the U S. map trade-mark will be your guide to dependable sand paper.

UNITED STATES SAND PAPER COMPANY, Williamsport, Pa.



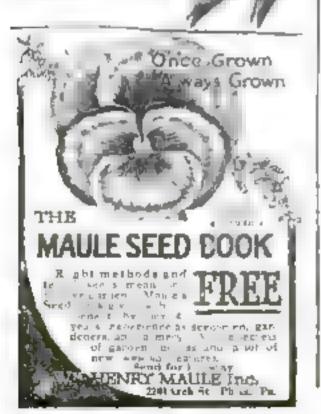


SPENCERIAN

Steel Pens

Brencerian Pens are as tried and tron at your old copy-book asloma. They are better than ordinacy pens because they write smoother and last longer. Send 10c for 10 different patterns and one well include, free, that farementing beat. "What Your Handworthing Reveals.

SPENCERIAN PENCO. 349 Broadway, New York



#### Making a Hairpin Act as Photographer

IT was during a picnic party. 'Twas I a lovely day, and a guy crowd. The inevitable camera bug was there

Not to be left out of the last film, the photographer decided to use a hairpin to help him out. The camera was focussed on the crowd and a suitable place conscientiously reserved for the camera man. A hairpin was stuck into an apple so as to leave a book by which the apple could be suspended. The camera shutter was set, and the apple hung upon the release lever, thus tending to trip the shutter by its weight. In order to give the photographer time to get back to the party another hairpin was booked on to the lever so as to keep it up, this hairpin being attached to a long strip of wrapping paper reaching over the body of the camera and tied to the camera tripod.

The paper was then ignited, and the author ran to take his place. The paper burned through, permitted the apple to exert its weight upon the shutter lever through the intermediary of the hairpin and—the picture was taken.—ARTHUR WORISCHEK.

#### Can You Drill a Hole Around a Corner?

WHEN asked the above question, the tendency would be to answer in the negative; but look at the illustration accompanying this article and see how one of the readers of POPULAR SCIENCE

> MONTHLY actually accomplished the seemingly impossible feat. It was neces-

> It was necessary to counterbore the hole E and also face the bottom of the hole. A small counterbore of correct size, and three ordinary automobile speedometer chain links — B, C, and D—did the trick

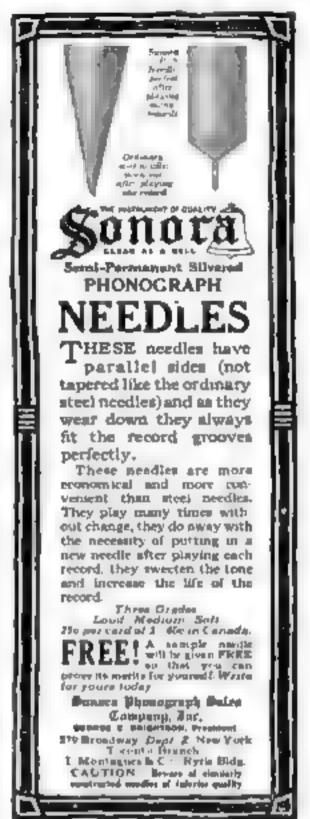
Owing to the construction of the work to be counterbored, it was necessary to do this as the piece G could not be disassembled without a great amount of trouble. The link B was held in the ordinary drill chuck, the link C was merely a joining link, while the link D was cut off short as shown. This work was finished quickly by the use of this ingenius arrangement, and it is an idea well worth keeping in mind.—J. W Moore.

Drilling a hole around a

corner is made possible

by attaching three speedometer links to the

bit and counterbore



#### HIGH SCHOOL PUPILS

Each \$3.00 to \$55.00 a week it may af et school breats. Are you interested? Then were su-







# Alladdim homes



Reduce

Save the Weste and It. Some the Cost it is usuden a stem scientifically prepares the materials and come see the wood. It is can case this on the cost of the last on and a sign of a control or good C. In a realist of the households a house allowable described is an process You can be a common a common for a survey for their is an Aladdin Home pracconsistence or an ice to a treatyra exacerts at h. Andre Seat medicantly number him established to many advantages. The Lumber that's Wested Costs Just as Much as the Luraber that's Good. The ser provides way to reduce present high prices of unities and absents to an eith and wave. The based is stem presented in the model, on set in the ready. To make the model of the Make of unity a reduced to tree have a figure of absents to the model of the had a first that a contact of the model of the had a first that a contact of the model of the had a first that a contact of the had a first that the make the

Greatest Distributing System in the World
Stillmen a fix audit Read of I was not now be made from the fix in your entirely producing very parties of the fix and a fix

he present indicate region.

Anadelina Six into Themship their Service means therefore a user, question do need and home forgott rates for builders there are need S. The contract a week at a second of men and given a contract of the second great mail eaching on offices.

#### Dollar-a-Knot Guarantee

Abdiling Salbara Krait oncounty have of their spates the distributed the papers are drained but as a surround salbar function of their sections of the input has been proposed greatered by one have no sharen been quarantly which but their first or a fifter had not from great a state or quality building dress and great. The hapter a rate of particles are the except their sections with five multiples of the form and are larger with a rate of the except their first or the fact of the bulk to be the first that the greathest too the same that he had no greathest too the same that he had no greathest too the same that the larger had not too the but of the same that the sam

#### Price Includes All Material

The Afadeling Book of House take a security for your Associated the pages partie that a filter traper to be to hope how house days of the pages partie to a page to be due to hope how how the pages partie to the page of the filter of the page of t

#### Read! Cut Aladdin Homes

Bear. A radio Homes shown in the Augatin too rage being have a charm for the one desiring a home. Busicanous of 4 come is 10 and 12 rooming on the spired was a normal and may one a section are well represented in this book. "Dwellings of tige and twee of ones. Coloria pro and estimated and the deriver of over the state of the state o hat mor and Inverses short at most made do set from actual photographs of each Aladdin Home as it is now by a and eccu troop many parts of he country. Poetras the most popular designs of heme taday. There is an important message for every limited by lifes in this book is deposits a remain or a set or nome at reduced cor s. I he pe you to avoid present high building prices. Send our a copy coday.

#### 20 ft. of Lumber From a 16-ft. Board

The Alabelia System of Himselmickas has been racticing for Hi reary to photocock to decid data out to be desired dather to the desired to the second dather to the desired dather to the desired dather to the desired dather to the desired dather to the second dather to the second



# The Aladdin Co. Bay City Michigan

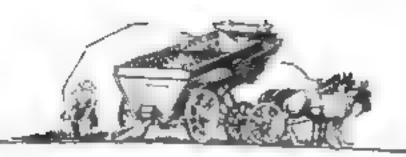
Branches: Hattiesburg, Ministerppi WILLIAM TOTAL CAPOLINA

ortland, Uregon Toronto, Ontario, Canada Nearest Offices









# Making a ton of coal do the work of two

Engineers for years now have coaxed, petted and fought coal, to make it give up its valuable energy—heat power.

It is a tantalizing problem because there is enough energy in a pound of good coal to lift up a ton weight a little over a mile.

Fire your cellar furnace as carefully as you will. Sift ashes and wet the coal. Try every means you know to get the most heat out of it. Still your best record will be beaten two to one by the central station in your town.

One of our biggest public servants, the central station, exists purely in its ability to sell coal to you—in the shape of electricity—at a few cents a horse-power.

They have been forced by necessity to burn coal economically, because their slim profit must come from the narrow margin between the cost of coal and the selling price of current, which is regulated by public commission.

And the record of their success is inspiring.

When one also considers the millions they have had to spend to achieve this position as the world's most economical coal users, their frugality becomes commendable.

If fuel conservation was practiced in every business as it is in Electric Light and Power Companies, the layman's dolfar would go further than it does today.

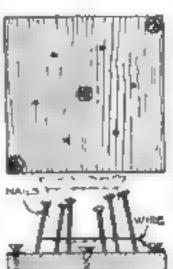
Published in the interest of Electrical Development by an Institution I has will be helped by whatever helps the Industry,

# Western Electric Company

No., Z. In Plorido as in Oregon, in Mains and in Texas, Western Electric across in every breach of electrical achievement – from musking machines to solephanes, from power and highting autitus to electrical equipment for railroads.

#### How to Make a Small Battery Socket

WHEN you want to put up a small battery lamp and can't find a socket, here's the way to make one



Making a miniature bulb socket in a hurry is sometimes necessary. Here's a way to do it easily and quickly with the simplest materials

in a hurry Use a piece of soft wood about three inches aquare for a base. Then drive five Oreix small wire nails with wide heads in the center of this base and incline them towards each other so they will form a section of a cone -that is. driven in a circular position with their heads nagrer together than the bottoms.

Also see that the head of each nall is a trifle higher than the one preceding it so if a line were laid around them it would form a rising spiral. Make this spiral go in the same direction as the threads of the lamp base and of a size to fit it. Then drive a larger nail or screw in the exact center of the base. Connect it to one screw and washer on the top of base for one contact and bind with a wire around the nails and connect it to a second screw and washer for the other.

#### Protecting the Spare Tire From Exhaust Gases

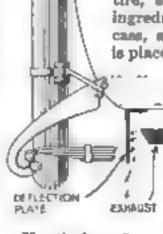
THE poisonous gases that issue from the exhaust of an automo-

bile very often cause the rapid deterioration of the spare tire. These fumes curt about the tire, eat away the live ingredients of the carcase, and when the tire is placed upon the wheel,

the rotten fabric explodes with a loud "plop"

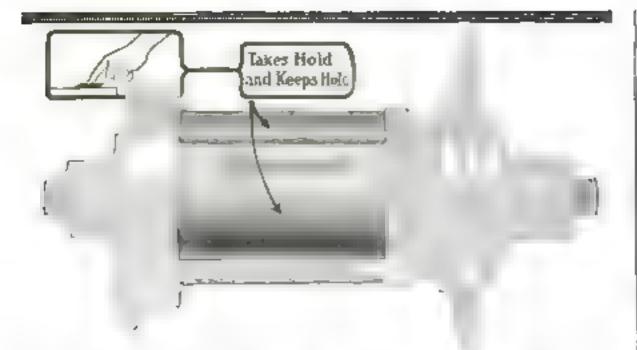
A piece of sheet iron bent and attached to the rear of the car, as illustrated, will deflect the exhaust and thus prevent the gases from injuring the

tire. Just for curiosity's sake watch the cars as they go by and note how many of them throw the exhaust fumes into the spare tire. You will be surprised.—Paul Fetherston.



How the fumes from the exhaust of a car can be deflected so they will not injure the spare tire





# MAKE THIS SIMPLE TEST

Here is a simple test which shows why the



# Keasons

- A Broking surface 6 5-10 oq. In .-- much sarged them without broken.
- 2 them superation forced equally by two weages at the hand and sets on even heat of unstribution ever extre bear hab auties.
- 3 Bernaue benfe obeer being eifter ban by firmar, eather
- 4 Porformany pedaling, the Morrow to apende metantly and pert very
- blore into hear against other brukes, to contact more week y
- 6 The Moscow le strong and waruppit with stand hard wee
- Misery dee named twos. fo'lowed by a fintelint guntuntering perfec jeter

has Arestze "brake shoes" and why these make the MORROW a better, surer coaster brake.

Slide a piece of smooth, hard wood along the top of a table. Shiles easily, doesn't it? Now take a soft rubber traser and attempt to do the

The wood will not 'grip' against wood, since the two materials are of equal hardness and produce little faction. The rubber, however, being softer than the wood, "takes hold" of it, and will not slide easily.

When you back-pedal a MORROW, the "drawn" inside the habits forced in arpend. This brings the desease broke thorn man direct contact with the meet caner marface of the hub. Being bronze, these brake sloce are too, hand durable, yet softer than the meel inner particle of the bul. For the reason, they "take had" smeathly and surely and deep book-greing you pustive and instant control of your beyels.



#### ECLIPSE MACHINE COMPANY

ELMIRA, NEW YORK



Demand

MORROW

the next

Bicycle you

#### 85000 IN SCHOLARSHIPS Entries Close Fabruary 1, 1930

If you want compare for one of Positive Attached the high a double behild white went in T is not not before the bill order one were published in be lighter bases.

Sobularskip Committee, Papalar Schoons Heachly 776 W 18th D. Hew Park



#### STARTS ANY COLD MOTOR IN A JIFFY

This Electric Intaka Heaty attaches to intake manifold or carburator—so deiling. Operates from dash switch.

Operates from dash switch.

Quick starting made sure in cubicet weather Fox any car with stor
age battery.

\$3.50

Welto for descriptive matter Dealers and Agents: Get Our Proposition

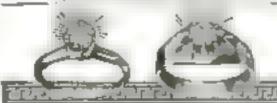
Electric Intaka Heater Co. AZZ Contland St. Jackson, Mich.

Western Distributores West Court Sailing Co.

#### CONCRETE ON THE FAKIN AND IN THE SHOP

This new book Blustrates and describes in risto. concrete may a lor range of the home worther

MOOK DEPARTMENT IN ... A SCIENCE SONTHLY



#### Send Your Name and We'll Send You a Lachnite

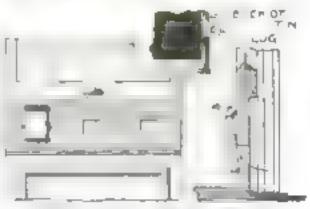
DON'T send a penny. Just need your name of the penny of the foreign and the penny of the penny o

Write Today Seed year name now. Yell or which Per with States of man at the same in man department of the part o

#### A Window Ventilator that Can Be Regulated

AN easily constructed and inex-I pensive window ventilator can be made from three tobacco tins and a board.

The board 8 in. high in cut so as to fit across the window frame closely. Three rectangular holes, 214 in, long by 2 in, high, are cut in the board. Openings of the same dimension as the holes in the board are cut in the



Make your own window ventilators from a heard and old tebaces They work to perfection

backs of the tobacco tine, with luge bent outward and fastened to the board at the three openings.

At the left of the illustration is shown the board with one can attached; at the right, the direction of the air currents. The covers are left on the cans so that one or all of the openings can be closed at any time. - JAMES CARROLL.

#### To Make the Pole Stick to the Clothes-Line

**TOW** many times have you watched The clothes-pole, accelerated by the wind, slide down the line and drop the newly washed clothes into the mud?

Many times we warrant. but here's a way to eliminate that trouble.

Use the ordnary 7 ft pole has a that noteb cut ln one end. Whittle opposite end to a sharp point and procure a piece of tin, of medium thickness

Clothet poles can't blow from the Boe if fitted with a tin clip and sharpened at the lower end

CLOTHES LINE

POINTED

POLE -

690UNG

measuring 1/6 of an in. wide and 10 in, long, bent to the shape shown in the illustration.

Attach this to the unsharpened end of the pole with small wire nails. The result will be that the sharpened end of the pole sticks into the ground and prevents it slipping, while the tin clip on the top end through which the clothes-line passes, makes it impossible for the wind to knock the pole from the line.-G. F. COLLING.



# Stop the costly delays with DAYLO

Every machine hour lost reduces your bank balance!

For Machinists: Daylo is a handy necessity at every planer, lathe, boring machine and drill press—it looks into the insides of the job—under the machine—nothing can hide in crevice, cranny, or nook. Unattached to fastenings or wires, Daylo looks everywhere.

For Bench Hands: Daylo is a veritable eye-protector for measurement reading—for insuring precision—for lighting up the dark places where tools are laid.

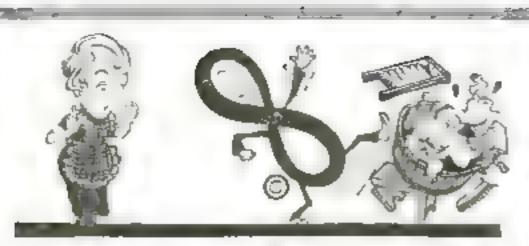
For Woodworkers, Textile Hands and Everybody Working amid Inflammable Materials: Daylo is as handy as a screwdriver. Its great utility and absolute safety make it indispensable in a field entirely its own.

There is a DAYLO to solve your difficulties—one of the many different styles of light that point the way to efficiency. All leading electrical, hardware, drug, sporting goods and auto-accessory jobbers and dealers carry Daylo. Or write us.

#### AMERICAN EVER READY WORKS

of National Carbon Co., Inc. LONG ISLAND CITY, NEW YORK





# Away goes the washtub

YOU don't need it when you have a 1900 Cataract Electric Washer, with its magic figure 8 movement!

By means of this figure the hot soapy water swishes through your clothes in a figure 8 movement; and four times as often as in the ordinary washer!

The awinging, reversible wringer also works electrically and can be awing from washer to clothes basket without moving or shifting the washer.

The roomy copper tub with its planished lining has not a single part in the tub to cause wear and tear on the clothes. Everything from fine underwear and wasts to heavy blankets can be successfully washed in the 1900.

It works easily and smoothly, too, and at a cost of less than 2c an hour. In 8 to 10 minutes out come your clothes, spotless and clean!

The water swirls shrough the tub in a figure d movement four times as often as in the ordinary mascher.



#### **Our Special Trial Offer**

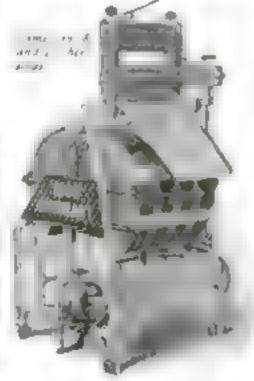
You may prove to yourself that the 1900 is the perfect washing enaching. There is a 1900 deater near you who will gladly demonstrate a 1900 Cataract Weaker right in your own home. Then if you wish, you may start paying for it on terms to suit your convenience. Remember, we also have washing machines operated by hand and water power.

Write us today for the name of the nearest 1900 dealer, and a copy of the book "George Brinton's Wife." It's a story you will enjoy. Molly, his presty little wife, had troubles of her own until she interrupted a bridge party, and then things began to happen.

## 1900 CATARACT WASHER

1900 WASHER CO., 206 Clinton St., Binghamton, N. Y.

> Canadian Factory and Office CANADIAN 1900 WASHER CO., 387 Young St., Toronto



Just connect it with the electric light and of it starts.

1900 WASHER COMPANY 200 Clinton St., Bioglambas, N. Y.

Please send me the name of the nearest 1900 dealer, and a copy of the story "George Brinson's Wide."

ARROUND ...

AREA TRACK MARKET MARK ANTARCOMPANIE

#### Automobile Drivers, Good, Bad, and Indifferent

GOOD driver is a born driver. A He possesses intuition that can never be acquired; it is almost an extra sense. He is born with a keen sense of sound, so that he knows the purr of his engine, and the slightest variation will strike him at once. In judging distances his eye is almost perfect, and he never makes a mistake when selecting a gap in traffic. He hardly ever touches the brakes, and all motion is smooth. To such a driver it is not necessary to run up to a traffic block. apply his brakes bard, then take the gap with a shding skid. He sees the block and judges the distance so that the way will be clear, cases off the throttle, and, when the gap appears, slides into it without using the brakes at all, without a change of speed or the tensing of narves by the other occupants of the car.

Another sense that is well developed is that of touch. It is no trouble for a born driver to start his car with a gliding motion instead of with a jerk, to pull up quickly in case of emergency without jar or jerk, or to restart the car when standing on a steep hill, accelerating the engine just enough to take the load at the moment he feels the clutch take hold, removing



Most automobile accidents result from pure carelessness. Avoid them by obeying the traffic regulation

the brakes. In appearance it is very easy, simple, and finished, but just how many drivers can do it? The next time you are out on the road watch this good driver and note why he maintains a constant speed. Find your car's driving speed and stick to it. More gasoline is used when you accelerate quickly, and it should not be done more often than necessary. Economy, like temperance, is moderation.

#### Marking the Indifferent Driver

The indifferent driver is he who drives safely, but without sympathy for his car. He never does anything very wrong, nor does he do anything very well. True economy in driving results from such things as proper spark control, turning corners properly, right timing and gear changing. He should cultivate the habit of coasting around corners or changing into second speed. Turning corners at speed imposes intense strain on all

# Buckle Over Alls and Coats than in Over Alls

Your money buys more quality, any work garments you ever put on. An actual wear test will prove that from the finest Union workmanship down to the smallest detail every care has been taken to make Blue Buckles unequalled in service and satisfaction.

It's a fact that among men who do the world's great industrial and farm tasks, and home-chore men, Blue Buckles are making new records for handing out the biggest value ever put into a work-rig1







# Where Upkeep Counts Most

Twelve million miles of wire, connecting cities, villages, farms; running under busy streets and across trackless prairies; these are the Bell Telephone's avenues of speech.

These twelve million miles of wire, throughout every foot of their length, must be kept electrically capable.

A few drops of water within a cable may cut off a thousand subscribers. A line snapped by storm may isolate a district. A wet leaf touching a wire may stop service. In most kinds of

work the lessening of efficiency means merely the lessening of service; but with the telephone, mechanical and electrical conditions must be practically perfect to insure operation.

The most delicate electrical currents in use are those of the telephone, and inspection must be ceaseless that the lines may be kept in constant readmess.

These conditions and costs must be met to provide this high standard of service needed and demanded by the American people.



AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

One Policy

One System

Universal Service



SAMPLES FREE! A book full of cloth samples the

all the latest colors, patterns, and weaver the finest quality that money can buy. Every savinest made to your measure, guaranteed has color and delivered free. In one dame.

Your Suit Won't Cost a Cent
If you have a few hours spare time your own
men shift to 160.00 a week for all or spare
time. No experience needed, Send no
modey—just your name and address.
LEGIS WOLD SHILL CO., but, is

And being an a street to the late of the Action of the Act

#### 96-Page Book Catalogue Sent Free

With have just immed a 96-page Book the most recent Scientific and Technical books and a new 32 page book list of new books of 1919. These are all the more welcome by reason of the fact that both the publishing and importing of books have been very much upset by the war and many books can only be supplied with great deficulty. This catalogue will be sent to any address in the world, free on request.

#### Scientific-American Publishing Company

Westworth Bidg. 336 Speedway, N. Y.

parts of the mechanism and should be avoided. It is also bad for the tires.

The car that is badly treated is always calling for attention, and its language is easily understood if one will pay attention and understand it, and if its talk is interpreted in time many dollars can be saved that would otherwise be spent in expensive repairs.

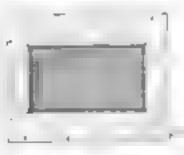
#### Who Wants to Be a Bad Driver)

And lastly comes the bad driver. He is selfishness and ignorance personlified, and his name is legion. He thinks he knows it all, yet he is brutal to his car, overdriving the engine downbill, whipping it uphill, speeding over rough roads, and earing pothing for the safety or feelings of other motorats.

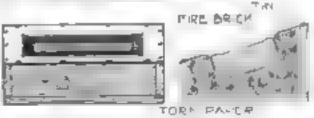
He is the type that slways does the wrong thing in an emergency, because he lacks imagination. He wears out the road and every machine he touches in a short time. If something isn't done to this class of driver, he eventually lands in the hospital. Only heaven knows what he will do. If you are like him, bewere and change your ways before it is too late. Of all contemptible things, the Road Hog is the worst.

#### Foot-Warmer Made from a Fire-Brick and a Box

THE accompanying illustration shows a simple but efficient foot-



warmer that may be used in a carriage or altomohile. It is constructed on the prin-



The nid-fashioned fire-brick now does duty for automobilists on zero days

ciple of the fireless cooker. A brick is used as the carrier of the heat, and torn paper as the non-conducting material between the metal brick-container and the sides of the box.

To make one, simply take an old box about 12 in, long, 8 in, wide, and 6 in, deep. Take a piece of sheet metal, and cut and fit to it the size of a large fire-brick, leaving enough metal so that when the form is set in the center of the box the edges of the box, as shown in the sketch.

Fill the space underneath and around the metal with torn paper, and nail the metal to the box.—HAR-VET MEAD. If you ask at the store for a Kodak camera, or Kodak film, or other Kodak goods and are handed something not of our manufacture you are not getting what you specified, which is obviously unfair both to you and to us.

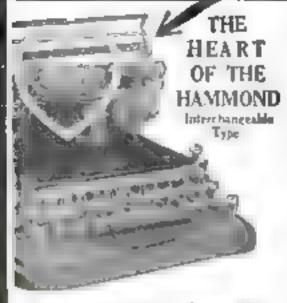
"Kodak" is our registered and common law trademark and cannot be rightly applied except to goods of our manufacture.

\*Trademark: Any symbol, mark, name or other characteristic or arbitrary indication secured to the user by a legal registration, adopted and used, as by a manufacturer or merchant to designate the goods be manufactures or sells and to distinguish them from the goods of competitors.

STANDARD DICTIONARY.

If it isn't an Eastman, it isn't a Kodak.

EASTMAN KODAK CO., Rochester, N. Y.





"Many Typewriters In One"

Here's a Typewriter that does everything any other sypewriter can do and then—

Writes every language from Fisk mo Indian to Kata Kana Japanese.

Writes over 365 different type sets.

Changes instantly from language to language or from type to type.

Puts the same power of emphacts into your written word as your voice puts into your spoken word. Gives you the symbols for every profession—mathematics, chemistry, engineering.

Writes your formulæ in perfect alignment.

No other Typewriter Can Do This.

Types for all purposes

and for all languages

anning to sell size of type

Perfect alignment

Cutomotic Dube impression

All on one MULTIPLEX

For ALL the marries of the Multiplex—

For ALL the mervels of the Multiples things as other machine CAN do-write for free pumphles.

Hammond Typewriter Co.
639 E. 65th St. New York City

# Build Your Own PHONOGRAPH

It's Easy With Our Help

Internating work—never places of Bare
options and place much not gare to an
option and the much not gare to an
object of the posterous description
of the state of the much the controls
option of the description and data site
of the description and data
of the description and data of the description and data
of the description and data of the description a

FREE Blue Prot

harten to Manche Water and the could be could be could be could be come of the could be could

the state of the s

harden Philippin



#### To True Up Irregular Band-Saw Rubbers

A GREAT many broken band-saws may be traced to lack of concentricity in the wheels of the machine. A rubber band about him thick is glued to the periphery of the upper and

CUTTYRY CLAMO

With this contrivance, it is porn a to true the most irregular rubber band in two hours lower wheels. If this hand were always of an exact thickness and perfectly set, its outer surface would run true provided the wheels themselves are true. First the main bearings should be examined and any loose-

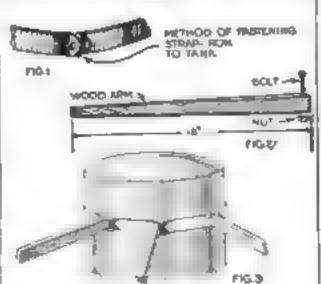
ness taken up, then the wheels should be tested and if found 'out of true' they should be turned in a lathe. After that the rubber assumes the responsibility and frequent breakage can be traced to its inaccuracy.

The Illustration shows a "set up" for truing rubbers right on the machine. This is the best way to do the work if it is at all possible. A small slide rest is set up on the table of the machine and clamped in such a posttion that the travel of the tool turns a straight cut on the wheel. C clamps are used to attach the angle plates on the table and to hold the slide rest to them. If it is possible to slow down the speed of the wheel, the tool will last much longer between grindings. If not, it will have to be sharpened alter each cut, for rubber wears a too very fast,-Donald A. Hampson.

#### The Kitchen Hot Water Tank as a Drying Rack

A SIMPLE drying rack for the kitchen hot water heater was made in the following way

A length of strap iron, long enough to reach around the tank, was procured and at intervals of 8 in. the edges were bent outward towards each other at right angles to the surface of the strap iron. These were



Here the kitchen hot water tank serves a double purpose by the attachment of a drying rack to its top

then bored with small bolts and the iron placed about the tank and fastened as shown in Fig. 1.

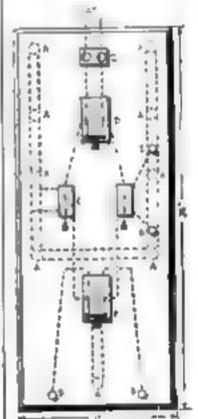
Then arms cut from a fir board were shaped like the one in Fig. 2, and bored at the thick end. They were then fitted into place and made to swing freely. Fig. 8 shows the completed rack.—Dale Van Horn.

#### A Testing and Outlet Switchboard

In the amateur's electrical den and the shop of the small electrical contractor or repairman, standard lighting current is often needed at an outlet and under a means of control without the disadvantages and inconvenience entailed by the usual plug-and-cord connection to a lamp-socket. To meet this need the switchboard here illus-

trated has been designed and constructed, at small cost, from standard wiring fittings.

The board proper is of pine 36 in. thick, 12 In. wide, and 36 in, long. Ita front murface is planed emooth, and the edges and corners beveled. Across each end cleate 2 by 2 in support it clear of the walk. to which it is fastened by means of 1 R by & in. lagscrews at each

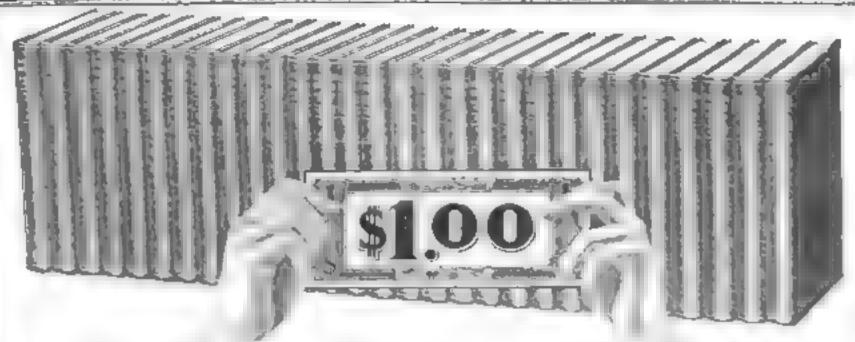


This type of testing ewitchboard supplies either alternating of direct current from terminal binding posts

All fittings are mounted on its front surface and all wiring on its back, the wire used being standard No. 14 gage rubber-covered copper. This is supported on cleats and knobs clear of both board and wall, while, where it passes through the board to make connections, it is carried through an insulated covering; this is necessary also wherever two wires that do not connect chance to intersect.

The leads from the standard 110-volt supply circuit are carried first to the fuse-block  $C_r$ , which may be of either the plug or the cartridge type.

From there they are carried to the 15-ampere, double-pole, single-throw knife-awitch D, which is the master switch that cuts off the entire current supply. From this switch each wire is carried to one of the 15-ampere, single-pole, single-throw switches E and E, which connect respectively with the cleat receptacles A and the pair of upper terminal posts B and B.



# Now as Never Before YOU NEED THE Encyclopaedia Britannica

HANDY VOLUME ISSUE

War awnite this great land of ours and set the stage for a tremendous industrial, spiritual and notial awakening. probably is not a man, woman or clubt among the more than 100, 100, 100, and shalltants of the United States upon whom the past five years has not had a profound effect. Great reforms are being hastened and this will be a better and cleaner world after the ordeals of fire through which it has passed. The participation of the United States as never before in the world's affairs has been placed in the people new laterage not hadred to the participation of the United States as never before in the world's affairs have been prought in men a mine's a mine in which never a a reserve out to it for knowledge which is absolutely increasely lodgy as more before. Where can people find correct audic matter and comprehensive to a matter on the many different subjects to which they are interested, as a consequence of the available of present in which they are interested and note between the first participation. The first opening is distanced. The Distance of the states of detailed and authoritative articles of great value to the histories than to the manufacturer in the important in the supportment in our minus for yours to come. It is the book for Americans today who are waking up to new thoughts, new work and new interests.

#### A Complete Library of Knowledge.

But this marvelous work with its 41.000 separate arts to be more than a guide for the energy sains business man of the 'rited Nastes, titing has to be a chann of the world-in wright merchant. The Britannica is a complete library of knowledge on every subject. It discusses in a templete library of knowledge on every subject. It discusses in a templete processing that you can understand every britanch of science industry librar are and passes, investigate and are a recovering basis of passes, investigate are a recovery chemistry, mesonally returnate, stemm, electronic greatest are an electronic greatest and physics. I consider such socially will fine in the Britannica is discuss effection. In answer to the fluctuarity will fine in the Britannica is discuss effection and to a return of the fluctuarity day come by your more mand and to a return electronic arms of the minds—if will tell you more about recrypting than you can get from any other suppost.

#### What Is Before Us?

There are many terious post-we problems confronting us. Do you understand the temperature of our promotest like? Why are the prives of commodities high. Will wages an still higher or down? Will the rest of living gravually drop? In here likely to be some great cataclesse the will serve to send prices and wages tumbling downward? Are you inclined to

the atampeded with four of what is before us? Are you sitting down and studying the (a is of past cases that were consensual atomas? Are you familiar with what has happened at er other wa s? In linguard after he Nagadeonic campaigns in he alted States after the Civil War, in France, to Centucky and to Neutrals of et the F after-Prussian was?

This withdrifted book, of houselder—the term Encyclopsedia Britannich—the afty or nga the whole were it is the reade. It tells all about frontes consistes their people, held history being progress, their transport their imports and expense. An hour a day with the B states a will alve you as clear and one-releases of the reade of the world as we Americans now have of the States of the Union.

Women Needs the Britannics as Never Before. The war has changed the stoom of women in an add and pullitraffe. The marker must keep abreast of the great houghts and movements that are taking place broughout the world that are vitally affecting into Woodan lodge in her availed this source important game in the world the Edwick change in her availed the Edwick change in her availed the Edwick change in the area in the boundary of a never before—she would be new status as a status who to the make her more efficient in the boundary world and as a mother to make herself broader and a bigget woman as she can track her children which and correctly.

#### BUT YOU MUST ACT QUICKLY

As First Payment brings you this Complete Set of 29 Volumes Centeining 44,000,000 Words, 39,000 Pages, 15,000 Mape and Illustrations. The belance is in Small Monthly Payments.

Our present small stock of sets is printed on the genuine India paper—the light, thin but opaque sheet which has proved an ideal medium on which to print the Encyclopedia Scitannics. Act today—NOW—by clipping the coupon and sending for the beautifully illustrated book telling all about the Britannica.

Sears, Roebuck and Co. Chicago, Ill.

Sign and Send This Coupon Today.

Sears, Roebuck and Co., Chicago, Ill. Complete the Physics on the free year likes ated Track to 10 A. or to be a property of the Physics of A. or death. Value asset of the Broading apparets of ground in the course

Buduther

FFO

91 eet 85-1 \0



# Finish This Picture

Fill in the missing lines. See how close you come to the original drawing. The above picture was drawn by Student Wyno Holcomb. We have a great number of students and graduates whose work appears in magazines and newspapers all over the country.

## Can You Draw?

If you like to draw write for our book. Read about our new method Home Study Course in cartooning thustrating, designing Learn at home, by mail, in spare time.

## Become an Artist

Illustrators, Cartnonists, Commercial Artists make big money. You can earn \$25 to \$100 a week and more. Learn under personal direction of Will H Chandlee, famous newspaper, magazine, advertising artist of 30 years' successful experi-

#### **Book and Outfit Free**

Complete outfit free to new students. Write for handsome book, 'How to Become an Artist.' Tells what Course includes, shows many drawings made by Director Chandlee and many students.

### Write Postal NOW

Don't miss our hook. Even if you have no previous knowledge of drawing, our I curse wil enable you to become a socressful curtoonut or illustrator. Many students earn money while they are learning. If you are ambitious to get ahead, to earn more money, write for our free book and special offer now. You can do as well as our other specially students? Write now for free book, "How to Become an Active" Mail letter or postal.

WASHINGTON SCHOOL OF ART, Inc. 1112 H Street, N.W. Washington, D. C.

From these switches the wires go to the center connections of the 15-ampere, double-pole, double-throw knife-switch F, the upper and lower connections of which go to the bottom cleat receptacle A and the pair of lower terminal posts B and B.

#### Flexible and Sale Arrangement

The result is an arrangement that is flexible and at the same time simple and safe.

The fuse-block C can be fitted with fuses of a proper size to afford a working margin of practical safety for the apparatus which is being supplied

through the board.

By closing both of the single-pole switches E and E, current can be drawn from either the lower terminal posts B and B, or the bottom receptacle A at the full 113-volt tension. If it is desired to introduce resistance into the circuit, lamps may be screwed into the receptacle A and the switch E opened, thus forcing the current through the lamps. If more resistance in desired, a grid or rheostat can be connected across the upper terminal posts B and B and the other switch, E, opened. By varying the number of lamps inserted and the character of the resistance or reactance, the voltage and current may thus be varied through a wide range.

One of the uses to which the switchboard is particularly adapted is the testing of lamp-socket devices. A flatiron, fan, or small motor suspected of defect can be plugged into the lower receptacle A, a lamp screwed into one of the side receptacles A, and the switch E opened. Then if, when the master switch D is closed, the lamp burns too brightly, there is a short circuit in the device. This fact can thus be determined without the blowing of a fuse or an elaborate galvano-

meter or telephone test.

Another advantage of the board is its convenience in supplying current from terminal binding-posts. When a motor or other device that is not fitted with an attachment plug connection is to be operated, trouble is often experienced in making a connection to a supply circuit where only lamp-sockets are to be had. The posts make the current available. In addition it is controlled by a proper switch and protected by a fuse.

Stripe of slate, hard fiber, or other moisture-resisting material should be used to support the binding-posts B. This will prevent a possible short circuit through the wood of the board in

rase of accidental wetting.

La constructing the board the fittings should first be mounted on its front, wiring put on its back, and then the whole hung in position, when it will be ready for service as soon as the supply leads are connected.

The entire cost of the switchboard should not exceed two or three dollars. It can be used with either direct or alternating current, -C. M. ADAMS.

### Your Work Will Pass Inspection



# Electrician's Wiring Manual

By F. F. Sengstock, E. E.

Thu book contains as the emential information needed for the proper (putalisation of lighting and power wastern as houses and other a hope It is we to to so the same high shory at his cricial high meet with any years' experience on the Chicago Board of Loderwitters.

Profusely illustrated and contains many tables and formulas.

Pocket size, Semble binding: Price, postpaid, \$2.50.

Book Dept., Popular Science Monthly 325 West 28th Street, New York

#### **HUNDREDS OF IDEAS**

For the Owner, Manufacturer, Dealer, Mechanic

# The 1920 Motor Annual

of the

#### Popular Science Monthly

The biggest book of its kind ever published —invaluable to everyone interested in Mator Vehicles and Accessories. It will a carately picture and describe more than 400 new devices and accessories and gives accres of practical ideas to the Owner, Manufacturer, Dealer and Mechanic

THE 1920 MOTOR ANNUAL is edited by nationally known automobile authorities. It covers all important new inventions and improvements to Cars, Trucks and Accessories.

Matching the wonderful development of the automobile industry—there are six and a half nullion. Motor Cara and Trucks registered in the United States—in the growth of the Motor Annual. The 19ch edition in limited to 100,000 copies. Order now if you wish to make sure of getting a copy.

Price, postpaid, 35c

#### Motor Annuals for 1918 and 1919

We have a few copies of the 1918 and 1919 Motor Annuals in stock.

Price, postpari, 1918 Moreor Annual, 25c 1919 Moreor Annual, 35c

POPULAR SCIENCE MONTHLY
225 West 39th Street, New York



# "He Deposits \$500 a Month!"

"See that man at the Receiving Teller's window? That's Billy King, Manager for Browning Company. Every month he comes in and deposits \$500. I've been watching Billy for a long time—take almost as much interest in him as I do in my own boy.

"Three years ago he started at Browning's at \$15 a week. Married, had one child, couldn't save a cent. One day he came in here desperate—wanted to borrow a hundred dollars—wife was sick.

"I said, 'Billy, I'm going to give you something worth more than a loan—some good advice—and if you'll follow it I'll let you have the hundred, too. You don't want to work for \$15 a week all your life, do you?" Of course he didn't. "Well," I said, 'there's a way to climb out of your job to something better. "Take up a course with the International Correspondence Schools in the work you want to advance in, and put in some of your evenings getting special training. The Schools will do wonders for you—I know, we've get several I. C. S. boys right here in the bank."

"That very night Billy wrote to Scranton and a few days later he had started studying at home. Why, in a few months he had doubled his salary! Next thing I knew he was put in charge of his department, and two months ago they made him Manager. And he's making real money. Owns his own home, has quite a little property beside, and he's a regular at that window every month. It just shows what a man can do in a little spare time."

Employers are begging for men with ambition, men who really want to get shead in the world and are willing to prove it by training themselves in space time to do some one thing well.

Prove that yet are that kind of a man! The International Correspondence Schools are ready and anxious to belp you prepare for something better if you'll simply give them the chance. More than two million men and women in the last 28 years have taken the 1. C. S. route to more money. Over 100,000 others are getting ready in the same way right now.

Is there any reason why yes should let others climb over you when you have the same chance they have? Surely the least you can do is to find out just what there is m thes proposition for yes. Here is all we sak: Without cost, without obligating yourself in any way, simply mark and mail this coupon.

# INTERNATIONAL CORRESPONDENCE SCHOOLS BOX 7662, SERANTON, PA, Bephala, willows philipping me, how I can quality for the people give, my to the public tectors which I can quality for the people give, my to the public tectors which I can a quality for the people give, my to the public tectors which I can a quality for the people give the people give



"Ride a Bicycle"

#### CHEMISTRY

Studenta, Experimenters and others interested in Chemical Work Send for our Latest Price List of Chemicals, Apparatus, and Photographic supplies

> BAKER & UNVERHAU WESTBURY, L. L. N. Y

# Secure a Motor-Cycle at Low Price

by posting a RELIABLE STEFFEY MOTOR on

I is where Ear to at at at in the less of the steel at the service at t

STEFFEY MPG, CO., Days. S., 505 Brown St., Philadelphia, Pa.



Operates with full engine pressure. Dependable, durable and guaranteed for 10 years. A necessity on every motor car and truck. Your dealer has them or write direct.

BUELL MFG. CO.



#### Make Your Lamp-Socket Yield Current at Will

By John D. Adams

This article, and several others by Mr. Adams which are to follow, will shortly be republished by the Populan Science Monthly under the title "Experiments with 100-Volt Alternating Current." It will be a book of much raise to amateurs and students generally.—Editor.

IF a switch with contacts at each side were connected to the alternating-current mains as indicated in Fig. 1, direct current could be secured provided it were physically possible to throw the switch from one side to the other one hundred and twenty times a second. A mechanical rectifier, so called to distinguish it from an electrolytic or mercury rectifier, is virtually such a switch so arranged that the alternating current operates it at the desired speed.

Not infrequently in experimental work one requires direct current, and

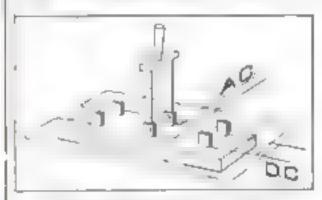


Fig. 1- Throwing this hand-switch back and forth 120 times per second, would rectify 60 - cycle current

the rectifier illustrated in Fig. 2 enables one to secure it at 110 volts, or even at a lower voltage, such as is produced by a small transformer. The resulting efficiency will depend, of course, largely on the accuracy of workmanship, but theoretically the principle involved may be made to yield very satisfactory results.

The device consists essentially of a pointed electromagnet, in front of which two insulated steel springs are mounted and tuned to vibrate at the rate of one hundred and twenty per second. Each spring moves between two adjustable acrew points, cross-connected as shown. A moment's study will make it apparent that we now have in effect a reversing switch that keeps step with the alternations of the current, and that if the two line wires are connected to the two springs, direct current will be available at the screw points.

If the operating coil had little or no self induction and the weight of the spring were negligible, it would cross the center line at the instant the current in the line in at zero and no sparking should occur as the current was switched from one side to the other, but in actual practice all these factors play a part. It is possible, however, to arrange the device so that

very little sparking will occur by having the contacts broad and properly adjusted, and sometimes the placing of a reactance coil in the main line will result in shifting the phase to a more desirable point.

in the illustration the supports for the adjustable contact screws are omitted for clearness, but in Fig. 3 will be found a suggestion for disposing of this feature A pair of brass blocks is provided for each side, and, after being insulated in the manner shown, they are clamped to the base with one acrew. The threaded holes for the adjusting screws should be slotted and sprung together slightly so as to hold the screws firmly in any position. The connections may be soldered directly to the blocks, or the wires can be clamped with screws as in a binding-

There is little that can be presented in the way of dimensions, as everything essential depends on the size and nature of the vibrating springs. Those used by the writer were 8 16 in. wide and about 1/64 in, thick. The total overhanging length was 21/4 in. with the contact acrews placed at the midpoints.

Procure two places of spring steel

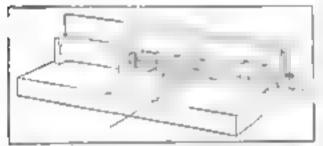


Fig. 2-Here is an electrical interrupter which will do the work of Fig. I more easily

about this width and thickness, and solder to the end of each a plece of 8/16 ln, round iron 1/4 in, long. Clamp three springs near the free end with a single screw, and between two pieces of hard rubber or fiber-leaving a space of about \$/16 in, between the springs. The fiber prevents the springs from touching and causes them to vibrate as a single piece, all of which is very essential.

The base should now be made ready, and a hardwood block firmly acrewed to one end to support the vibrators, which are held in place by clamping them to the block with a piece of fiber beid down with a wood scrow in the center

The process of tuning may now commence, and in this no little patience will be required to secure the proper rate. First clamp the springs with about un inch projecting, place the magnet to one side and at right angles. and find the most effective length, which will represent a rate of two hundred and forty. Multiply this by 1 414, and clamp the springs at the distance so determined, and tune again.

The new point will be for the desired rate of one hundred and twenty. When the adjusting screws, however, are placed in position it will



many others, so why don't you double and treble your pay? You can do it. With double and treble the amount you are now earning you can go to the bank each pay day and put away a sum of money for a "rainy day," or that can be used for profitable investments or building your own home. Bigger pay would enable you to own an automobile and to get many pleasures out of life that you cannot now afford. To be able to go to the bank each pay day and steadily build up a bank account without missing it is alone worth any effort it may take to increase your earning power. Then think of the things you want that are not pictured here. Whether you ever enjoy those things depends entirely on yourself.

Every day you see men around you stepping up into better jobs and drawing bigger pay. It isn't a question of "how do they do it?" You

### Don't Dodge a Better Job

Promotion and better pay is up to you and not the boss. The big pay checks go to those who can think, act and do things for themselves. Training will make you a master of your work and place you in the job you want. There are no two ways about it; while you ignore the benefits of training you are dodging a better job. Without interfering with your work you can prepare for bigger pay right in your own home—after supper in some of the hours you now waste. The thousands who have marked and mailed the Coupon to the right have doubled and trebled their pay. That is just what you can do—so do as they did. Send the Coupon.

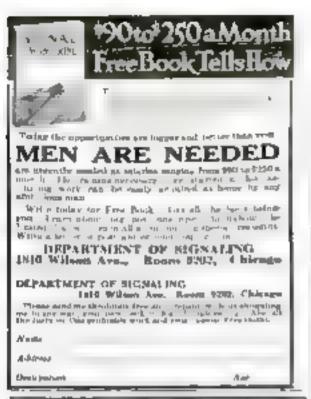
know they have trained themselves to handle the jobs ahead of them. The question is "WHY DON'T YOU DO IT?" You want the things that better pay will bring you so why not decide NOW to prepare yourself for a better job and better pay?

# OF CORRESPONDENCE

Broads Kingthoop
Lawyer
Brinings Manager Mexican Union Asserting
Jesuphene Engineer
Destromen and Protogram
Automobile Requires
Automobile Requires
Fire Inflation
Sandary Engineer
Fire Inflation
Engineer
Heating and Ventilating
Engineer
Heating and Ventilating
Engineer
Coni Engineer
Bertwer Engineer
Bertweries Engineer
Bertweries Engineer
Bertweries Engineer
Bertweries Engineer
Bertweries Engineer
Bertweries Engineer
Wireless Operator
Architect
Building Contractor

. . . .

Address





ORE Finger Print Experts are needed. Men who are masters of this profession are scarce. The demand for Finger Print Experts is great. As a special inducement we will give you free of charge our new easy reading course in Secret Service Intelligence if you act at once

#### Be a Finger Print Expert

Build up a husiness on the basis of a trained brain. You can do it as a master of the Finger Print profession. There is crying need for Finger Print Experts right now and the demand for these trained men is growing every day. A profession that offers womerful opportunities for advancement. Governments, corporations, pouce departments, institutions and individuals have constant use for these specially trained men. The work is functioning and

#### The Pay Is Big!

No special education is necessary. You can become a master of this profession by studying at home in your spere time. Expert Finger Frint men travel all over the country solving mysteries that baffle all others. They are important men and highly regarded and envised by every one.

#### **Mail the Coupon**

Oct full information about this great profession and our big offer of a free course in Secret Service Intelligence. The mastery of these two closely albed professions places a brilliant career within your grasp. Achievements that will immediately place the stamp of success upon you, are now possible. Send this coupon for full information NOW

#### University of Applied Science

Deak 9202, 1772 Wilson Ave., Checago

Continues. Weather any obtagains whosever a set que sout on Fill bank no cares from and over offer of a new respect to better for top (glb-Q)respect

A arms

delitrerr

ter Gerupation

be found necessary to increase this length, as the greater part of the vibration occurs between the acrews and the free end. Increase the length slowly step by step, giving the springs a brisk start at each trial. When the proper point is reached there will be no doubt about it, as the vibration will continue with surprising activity when once started.

When the preliminary trials are finished, assemble the various parts permanently, clamping the coil to the base in a manner that will permit of its being moved back and forth longitudinally. Adjust the screws to within a hundredth of an inch of the

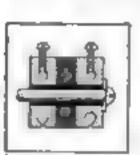


Fig. 3—Support for adjustable contact screws

springs, after which the device may be tested. At first place a bank of two or three lamps on the alternating current side, and then connect up a single lamp on the direct current side, which should be found to burn rather dimly but steadily. To

be sure that direct current is being actually obtained, remove the single lamp and dip the two wires in a glass of salty water, and if the current is direct a steam of bubbles should arise from one of the wires—that is, the negative one.

Another interesting experiment in this connection is illustrated in Fig. 4. Here we have a straight steel spring tuned to make one hundred and twenty vibrations per second. A very thin strip of brass or copper is placed alongside of this, and both are clamped in a horizontal position to a suitable post.

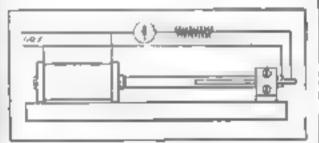
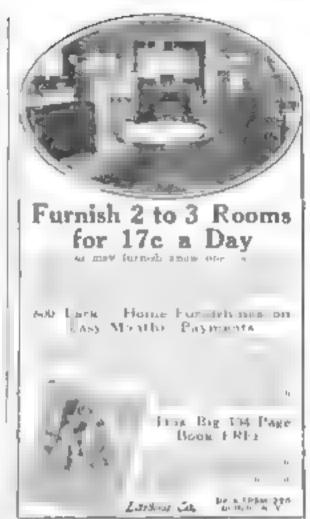


Fig. 4—A rectifier which uses but half of the alternations, gives pulsating current

The small strip is insulated from the spring, however, by placing a piece of card or beavy paper between them before clamping. When the steel spring is at rest the strip should he as close as possible without actually touching.

Connect up as indicated, placing one or two lamps in circuit and also a galvanometer. When the spring is finally set in vibration by the coil to the left, it is evident that a contact will be made between the spring and the thin strip surty times a second, and as the line current makes a completer cycle in one sixtieth of a second, the current, though intermittent, will flow in the same direction at each contact, as will be proved by the deflection of the galvanometer









20,000 Caronam Ca ship Free Agests Wanted Bervice Auto Equipment Corporation 908 Service Sidg. Kanesa City, Ma.



Wonderful, new device, guides your hand; corrects your writing in few nave. Big improvement in three hours. No tailures. Complete outline FREE. Write C. J. Osment, Dept. 52, %t. Louis, Mo.

#### \$1800 for a Story!

RECEIPT. The Assertions without was good 31000 for an action above the property in the little parties at her persons have been as all persons for any fine fraction and for the persons are all persons for the persons and for the persons and for the persons are all the persons and for the persons are all persons and the persons are all persons and the persons are all persons and action are persons and the persons are all persons are all persons and action are persons and action are persons and action and action are persons and action and action are persons as a person are persons as a person and action are persons as a person are persons a

Write Today by non-handet Bow To Wella, "
Write Today by non-handet Bow To Wella, "
Byola disp new box y man o Wella Today New F
1000-5788 SESTITUTE, Short Story Dept.
Boys. 1207

#### The Chameleon Barometer Predicts the Weather

ONE of the most novel weather tellers is that known as the chameleon barometer. It is a very reliable device for indicating coming changes in the weather, and is very easy to make.

Obtain a piece of stout cardboard. If it is round the effect is all the better Right in the center paint a dead black circle on which the chameleon will later be mounted. Divide the white ring surrounding it into four equal parts. These are marked Wet, Variable and Dry. The lower space is lettered Chameleon Barometer



You can make a weather prophet whose predictions are always sure to come true

Now color the Wet space pink, the Variable section purple and the Dry space blue. These give indications of the color that the chameleon will take on according to the conditions of the weather at that time

The chameleon should be made from good blotting paper. Sketch out the animal with a pencil, making a strong outline, and indicating the leading characteristics. Then cut out the picture and soak it in the following solution: Cobalt chloride, 1 part, gelatin, 10 parts: water, 100 parts.

When the picture has been thoroughly saturated fix it with strong glue on the black area in the center of the cardboard

Mr. Chameleon will then play the part of a weather prophet, changing color in relation to the humidity of the air, and you'll find that he predicts more truly than the human prophet.—S. LEONARD BASTIN.

#### Phonograph Needles Make Excellent Push-Pins

HOME-MADE push-pins are just as good as those you buy and even better, for they can be made in a variety of colors.

As nearly every home is fitted with a phonograph you probably have an

# Prettier Teeth

#### Safer Teeth-Without a Film

All Statements Approved by High Dental Authorities



#### It Is Film That Mars and Ruins

It is known today that the cause of most tooth troubles is a slimy film. You can feel it with your tongue.

That film is what discolors not the teeth. It is the basis of tartar. It holds food substance which ferments and forms acid. It holds the acid in contact with the teeth to cause decay.

Millions of germs breed in it. They, with tartar, are the chief cause of pyorrhes.

The film is tlinging. It enters crevices and stays. The tooth brush does not end it. The ordinary tooth pasts does not dissolve it. So millions find that well-brushed teeth discolor and decay.

Dental science, after years of searching, has found a film combatant. Its efficiency has been amply proved by chinical and laboratory tests. Able authorities approve it and leading dentists all over America are now urging its adoption.

#### A Free Test to Every Home

This new method is embodied in a dentifrice called Pepsodent. And a 10-Day Tube is sent to everyone who wishes to prove its efficiency.

Persodent is based on person, the digestant of albumin. The film is albuminous matter. The object of Persodent is to dissolve it, then to day by day combat it.

But pepsin must be activated, and the usual agent is an acid harmful to the teeth. So pepsin long seemed impossible. But science has discovered a harmless activating method. And millions of teeth are now being daily brushed with this active pepsin.

We urge you to see the results. They are quick and apparent. A ten-day test will be a revelation. Send the coupon for the test tube. Compare the results with old methods, and you will soon know what is best. Cut out the coupon so you won't forget, for this is important to you.

# Pepsadent

The New-Day Dentifrice

Now Advised by Leading Dentists Everywhere

#### Ten Days Will Tell

Note how clean the teeth feel after using Popuodent. Mark the absence of the tiliny film. See how the teeth whiten as the fixed film disappears. You will then know what clean teeth mean.

#### Ten-Day Tube Free

THE PEPSODENT COMPANY,
Dept. 972, 1104 S. Wabash Ave., Chicago, Ill.
Mail to-Day Tube of Pepsodent to

Name

Address

### Make Your Mind a File-Not a Pile

Stop Forgetting

By Prof. Henry Dickson

Process materials on Manager Process and Processed Deckson Manager Johns, Charges

indexed facts? you to blows an aude When you want to not notes. remember & name, place or date, must

you grope in vain to locate the infortraction? Summoned to give facts and post or postal for state-figures—does your mind become
a blank? When called upon to Perfect Your property and trail from a

down-hum.anted?

Without Memory, off.

the knowledge in the

world becomes weech-

less. " Stop Forget-

ting" makes your mind

1 Can Make Your

Mind as Systematic

and Forget-Preof as

a Cará Indea File

-master of its

ramelications - | n-

Steplorgetting

a file-not a pile.

p.ace re-

S your mind a memory. Develops con-serup pile-filled ordermans ordermans with a lot of un-bashfulness enables men execupently with-

Dickson Memory Training Has Helpad Theyseads

FIII out and esail cou-

create from students who had pour memspeak—do you seek wildly to collect your thoughts—nitter a few
Command What
Comma Salary You Will facts, from which you can be

mark s-and att Special Offer on "How to Speak on Public"

This de tuse, bandsomely This de june, handsomely fituatrated, \$2 inote from to recycle. Will train you to think on road factor express yourself a string remaining to many the train to the train train to the train train to the train trai and of a sheetened.



Rend your name and adfree of depart or postal.

I will also send you a 'restrict of for unique copy-rept of for unique copy-righted Managey Test,





PROF HENRY DICKSON, Principal, Dickers School of Munory, 1929 Hauret Building, Chicago, M. Send me year Free Rock. If we by Memorature," also part to are how to obtain a free copy. Ohe however Most to Speak on Public. notes Memory Test Bree.

Orre PEARS

the mant thorough.

almoles. ayutem of

Thoroughly trains the WANTED—A Representative in every factory in the pulse)
Planes. Powerlast Schlings Indonesia 200 West Such
Street, New York.

ptead of a victim of its disordered details.

My course of Memory Training perfected

hy 20 years' experience, is recognized as

# BIG BROK

#### BURN LESS COAL

17 I an improved all-can pipeless furnam you conas your assisted in my Thin effects furnaments
intelled begins plant being and vertileness to
bettle. Of hidder any grate of seed thouse a security allthan a shore I to else to expendical
sites supplied of other expendical
Arm up our bestell in to a day.
There are there had no are wholes
sale pricess of ope Handy Share
though Armittan

#### De Year then Phenting and Heating by the Catalog Fit Machini

By our new plan adjusted the stability of healthy plant he his neigh heast means the his neigh heast feel to be totally shrifty a subsection of the sense for the tenter matter and each entitle feel to the stability of the feel of the feel



#### THE HANDY MAN BOOK

The will address two hours at will sell you not with the product of the house of the product of And the de the more

We have spaced at other make in the property of the property o

#### HARDIN-LAVIN CO.

District the state of the said bosinem al

1525-36F Curreys Green Ave., Chicago

# AN EASY WAY TO

on a stage minery the enterprendent. On he the material legisters: One man on a 1 mode 100 co day. Tithers average (CS) to \$100 a readth

#### Tire Repair Outfit Don't by The Manufacturery

Dom as good such as the high high spiced valencing out fits it to be seen understand that it is the seet understand that the first actual and that it is the learness of the seen and the seed that the seen as the languages on well-throughout or remaining.

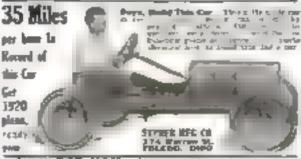
FREE Book How to these a Tire it year Brook is telly book to meet too meeting.

C. A. SHALER CO.



Hella, Tapplian Bullar, Wrotele. Beiter, Mantolie, Carrel, Japan Sanje er Benje

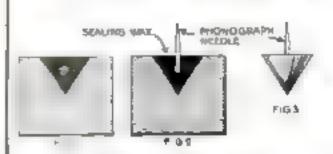
Worshartal new creatum of free bing note receiving again. To their percess in reach form in the given in 1921 degrees Wheth, Mandelm, Other in Castan Harvalla certise series. For a filmest or Party mana-liquis, from Finite grand objects for broads only. We arrange the ex-cess or ne charact. Complete weight from, Words more. No it Agratian, MINERALANI SCHOOL OF MINE, Inc. Dept. 27 GHCANG, III.



SIGLOS FOR YOU o FOR YOU Has not confine a make a week our a you ware me? It ste are by representing Port ask Science Morrant \$ 0 10 a week our # 500 dung With post wow / HES West With Street, Plea York,

abundance of used needles which you have heretofore thrown away

Procure some sealing wax in different colors and a block of wood for the



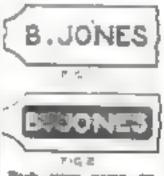
Push-pins are available about the house. To make them in various colors in a new and useful idea.

mold. Fig 1 shows how the black of wood is cut to form the mold. Of course the mold may be made in any form to suit the individual fancy. Melt the sealing wax over a candle until it is even with the top of the mold, let it begin to harden, then thrust the needle into the wax. as shown in Fig. 2, and hold the needle in position until the wax hardens. When it is cold, knock the bottom of the mold upon a hard surface and the finished push-pin will come out easily. This is shown in Fig. 3.

If the mold is well olled, the pine will emerge more easily than otherwise.—ARTHUR GOLDENBAUM.

#### Marking Tools for Purposes of Identification

T is convenient to know your own I tools when you see them; yet if they are not marked with your name or



Buch your name on your tools. Then if they are lost or stolen you can easily identify them initials are often very difficult to identify. The best place to set your name is on the steel portion of the tool where it is exceedingly difficult to remove it. This process is called etching. With a smail

brush cover the tool surface to be etched with beeswax that has been mested. If the wax hardens before the surface can be covered, warm the tool slightly. Then, with a knife or other sharp instrument scratch your name on the tool

The etching liquid is compounded as follows

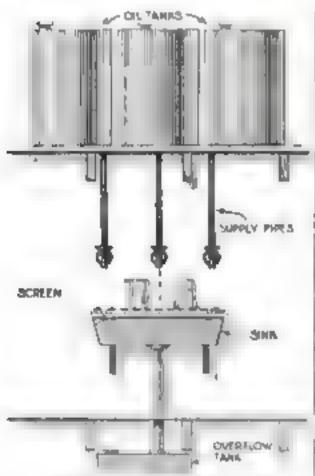
Iron or steel .. Nittric acid . . . . . 1 part Water Brass or copper Nitric acid . Muriatic acid 1 part Acetic acid .... a parts Alumiaum Alcohol Antimony chloride . I parts Water .... 15 parts

Hard steel will require a stronger solution than soft steel; therefore if it does not etch fast enough add more nitric acid.—HAROLD F. NEFF.

#### An Improvised Oil-tank Arrangement

EVERY garage owner has to contend with a shrinkage in his lubricating oil which is always attempting to make inroads in his profits. This is largely due to waste and loss in handling. A few drops here and there as it is being transferred from the supply tank to the customer's car, now and then a loss of a pint or so as the faucet is left open too long and the measure overflows—this is how losses are apt to occur.

By using the arrangement shown in the illustration the loss is entirely eliminated. The measures are placed on a piece of heavy, coarse-meshed acreen, covering the old sink, over which they are filled and turned upside down when not is use. If the faucet is left open by mistake the oil



The oil waste in a garage will be reduced to a minimum if this oiling system is adopted

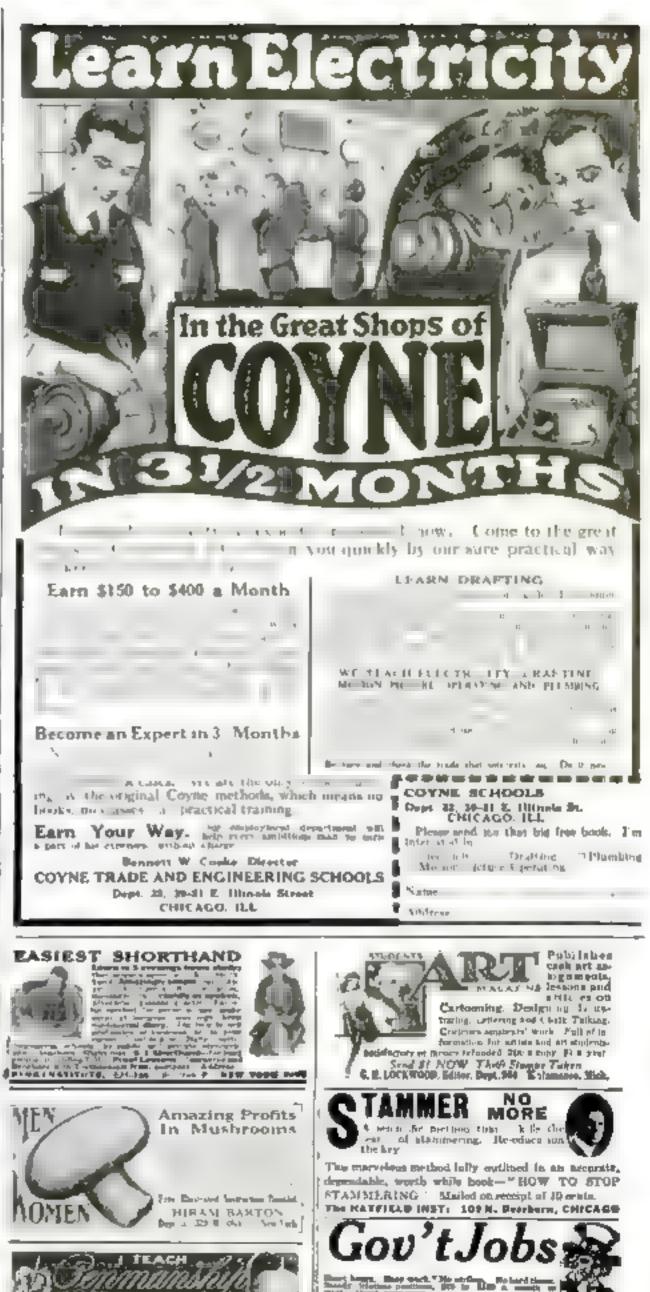
will simply drain down into the tank below.

The economizer can be made with but a slight outly for labor and material, and will prove a great moneysaver.—PAUL L. FETHERSTON.

#### Tires Wear Better in Winter than in Summer

HEAT is one of the worst enemies a tire is called upon to face, especially friction heat. The winter air leasens this heat and makes it possible for a tire to last longer in spite of the extra pounding it gets when snow and ice are on the ground.

This rule applies, of course, where the tire is confronted only with the ordinary bad roads conditions arising from frozen highways. But where the motorist must drive his car over rough roads deeply cut with ruts, only the most careful driving will give him a full return on tire investment.



Patterno Civil Service School, 162 News Miles, Rochaste

C W RANSOM, all Eases Sig. Kom



The opportunity is here for expert accountants. Baphanard business methods must give way to effi-ciency. That means a greater demand than ever before for the man trained in motion accounting.

#### The Man Wanted

Opini argumentions very many than the earl the edgest beintands unally of Thur deed the man who can show them where story thank who can show them where story thank with can man the what of time hid wester a feet of only only on the cart on the story in the too with a feet of the story in a particular particular than the cart on the story in the story of the story of the story of the story in the story in

Get Instruction from the LaSalle Experts

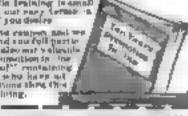
The Labolic method will brain was by easily motor the circul repervision of William II instantially A. II. 1. P. A. Instantial a month of William II. Instantially A. III. 1. P. A. Instantial in a platfief if setting Public Accountments transmitting morphism of the American leads to a fine-central braining morphism of American and Organizations. But the Principles of Accounting Auditing Commercial Lyunder of Research Battagers of Research and Principles of Accounting Research Section 1. Commercial Lyunder of Research Description of Accounting Research Section 1. Commercial Lyunder of Research Description of Accounting the Commercial Commercial Description of Accounting the Commercial Commercial Description of the Commercial Commercial Description of the Commercial Description

Train by Mail

Built poor project position while proparing for a higher than 19th project pass than it model. The special of such have seen quick advantables that impressed said that see green pass of our maintenance were presented and our maintenance are green as a few positions of the project of the project pass of our maintenance are green as a few pass of the project pass of

The cost of safable testainer is small and you can pur up no out every termine is being every month of you dealer

Write will the component of the process of the proc



#### LASALLE EXTENSION UNIVERSITY "The Longust Hustman Training Inselments to the World"

Chitage, Bissis Dept. 283-H

Without earl or obligation on my part please earl me parkinglars regarding very fit ensure some of Transless In Higher Assumit on and your escapions Service. Also year leads. Try Your's Promotion in the and Freel's

Marsur ....

Present Position

Raise Belgian Hares

for us. Wonderful profits easily mails at home. We furnish high grade strack and pay you \$7 to \$12.50 a pair and express charges for all you raise.

Madratad entalog and evatract Free WAYS OF MAKING MONEY

25th Century Cook of Recipes. Foresties and President of the new property of a second from the second of the secon

From most estimate the specific of the country and the great and the great for the country and the from the country and the from the from

#### Put This in Your Pipe and Smoke It

Be a pipe mechanic and repair your own smoking apparatus

SHORT time ago By Albert E. Jones the stem of one of my favorite pipes became clogged ber pipe stem, it is a very simple and no effort of mine could dislodge thing to do. A wire in run through the obstruction, even though I used the stem to prevent the hole from

steel knitting needle and flattened one end a little and with a file sharpened it as one would a drill I also filed it comewhat flat for about an inch back from the point to allow the drilling room to back up. Uning the needle &s & drill I soon had a good passage through the stem and now the old pipe drawn better than ever.



Pipes, like machinery sometimes get out of order but if you know how to repeat them it seves buying a new one

If you want to change the shape of a hard rubwire. After a little thought I took a flattening and the stem is heated -

> 'preferably in boiling water

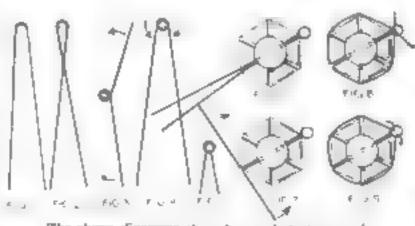
It will noon soften enough to be bent easily to any desired curve. Care must be exercised not to hend it while the rubber la still hard. After it is best mave the wire back and forth to free it and then allow the stem to cool, after which the wire can be take 1 out altogether.

#### The Hairpin Competes with the Cotter Key

THE method of using a bairpin in L an emergency, described in the following paragraphs, is very useful to the motorist.

By twisting the hairpin as shown in the various figures in the illustration you can make a practical cotter key for screw-heads or bolt-ends.

These are forever getting lost or



The above diagrams show how a hairpin may be twisted around a nail to form a cofter key fir a bolt head. This idea is excellent in an emergen y

broken, especially those in the car springs, and it is very useful to know how to replace them immediately The repair which forms the subject of our illustration can be done with a single hairpin in less than two minutes with no other tool than a pair of pliers.

The double twisting of both ends of the pin in the ring make improvised pin absolutely secure M. R. JOURDAINE

#### Electric Fan Dries Photographic Plates

Y an extremely simple device a D small electric fan can be converted for drying photographic plates rapidly, and with a little care no dust will settle on them

Construct a wooden box of such a arse as to accommodate the size of the plates to be used. When the box is completed, screw on the inside, about

> half way up, cross pieces for supporting a shelf

The shelf should be made to fit easily inside the box and it must be bored with 🛂 in Tholes In rows throughout its length spaced so they fall between and not under the edges of the plates

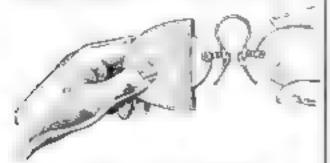
Racks having saw cuts in them to hold the plates are glued lengthwise along the top inner edges of the box. A hole about 2 in. In diameter 16 bored in one end of the

box, under the shelf, to take the end of a cardboard funnel. This funnel might also be a megaphone, provided there is one handy. It should be large enough at the big end to fit over the guard of the electric fan

To operate, place the wet plates carefully in the rack, put the small end of the funnel in the hole in the box and run the fan at "slow." The plates will dry in about five minutes .- V. VAN WINKLE.

#### To Clean Spectacles Quickly and Efficiently

A LITTLE chamors lined pouch like those usually supplied with watches, makes a much better spectacle cleaner than a handkerchief. A handkerchief has a certain roughness



The chamois pouch for cleaning eyeglasses is far supertor to the handkerchief, for it really does an efficient job

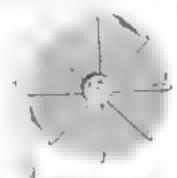
and always leaves lint upon the lens, whereas the chamols is soft and really cleans when used in the manner shown. These pouches are easy to make and once you adopt this scheme you will never be without one.—J. W. MOORE.

# Eliminating the Unraveling of Friction Tape

ELECTRICIANS and other mechanics who have use for friction tape in their work generally experience trouble due to the unraveling of the outer edges of the tape when it is being unrolled for use.

This annoyance can be easily over-

come by scoring each side
of the roll in
radial lines with
a charp blade,
as chown in the
accompanying
sketch. This
simple operation does away
with the unravcling, since it
cuts the outer
threads of the



Stit elightly the edges of the tape and it won't unravel or get ragged

tape which are the eause of all the trouble.—Peres J. M. Clute.

#### To Make a Handy Gas Soldering Torch

SMALL soldering jobs which must be done in cramped quarters can be quickly and easily accomplished with this home-made gas blow torch. The torch is made from discarded



This gas torch is simplicity itself and serves exactly the same purpose as the expensive manufactured article

pipes and fittings, the illustration showing plainly how it is assembled. The torch is attached to the gas main by a length of rubber hose, while another piece connects with the air line.—RONALD L. PRINDLE.



# Learn Public Speaking 10 LESSONS FREE Write - quick - for

particulars of this extraordinary offer, an opportunity you will

never forget if you take advantage of it. Ten lessons in effective public speaking absolutely FRFE to those who act promptly, to introduce our course in localities where it is not already known.

We have been been been as world and manning speaker—to inducate a "beautiful for a state of the same of the state of the s

#### WHAT THE COURSE TEACHES YOU.

How to talk before tone and or sodge; How to address board

How to propose and re-

flow to propose and a

How to make afterdinner steerbes

Home I can erse inter-

Flow to write better jetter

How to sell more goods, In a to crain your

How to estable your

Here to develop self-

How to acquire a winring personality

How to streamthen wont we power and among tion

How to become a clear, accurate thinker,

How to levelop your power of concentration.

How to be the master of any situation.

#### **New Easy Method**

perfected and taught only by Prof. R. E. Patthon Kine, for our Dom of the Dunite Sunsking Department of the Columbia Unique of Lagor nor can be beared in 15 minutes a an Prof. K or is as of the foremost authorities in the country on public speaking and mental development. Do not let this chance escape y 45.

### Offer Limited

#### Send This Free Coupon Now

This Special Offer of TEN LESSONS FREE in the few testicity for advertising purposes and will be a bettern without notice. Write now, before it expects and receive full particulars with annulment tak by return mail. No obligations of any kind. Jection of and mail this free evapore of a postal with

#### FREE LESSONS COUPON

1202 Manhatton Building, Chicago

I am interested in your course in Effective Public Speaking and your offer of ten lessons free. Please send particulars. It is understood that this request places me under no obligation of any kind.



# SCHOOL

YOU ARE BADLY if you lack NDICAPPED High School training.

You cannot attain business or social prominence. You are barred from a successful business career, from the leading professions, from wellpaid civil service jobs, from teaching and college entrance. In fact, employers of practically all worth while positions demand High School training. You can't hope to succeed in the face of this handicap. But you can remove it. Let the American School help you.

BIG PUTURE The Course. prepared by some of America's leading pro-lessors, will broaden your mind, and make you keen, alert and canable. It is complete, amplified and up-to-date. It covers all sub-lects given in a resident behind and resets all requirements of a 21 gh School training. From the first leason in the last you are parefully examined and coached.

#### use spare time only

Most people side away \$72 hours a week. Probably you do. Use only ane-doth of your waster hours for at my only ane-doth of your your present hands ap within the peter. You will cappy the leasting and the leasting you will gain will well repay the time speak in study.

So that you may see for yourself how thorough god

we invite you to take any features in the Plant School Course or any ton send that School Course or any content of specialized training to the couper between before deciding whether you with to profitting if you are not then satisfied, we we retord your money in full. He absolutely gudranted sensitives. On that besin you own it to

Check and man the rest. NOW for full particulars and Free Bulletin.

> MEDICAN SCHOOL OF CORRESPONDENCE Dupt, H-7f2 Chicago, Illinois

ASI

Explain how I can qualify for the pention acceed

Minth-Method Fudurate Literary at Different Luco Light & Privat Sold. III developerate Fundament Feledruph Haginess Witnessen Operation Arrelit est halfiding a ontractur Checks hangtment Pinichical Flighteen Mirellation | 1 Officers Marip Eurper (5) 850 Jr 65 Margin Maginier

Designation and Designer

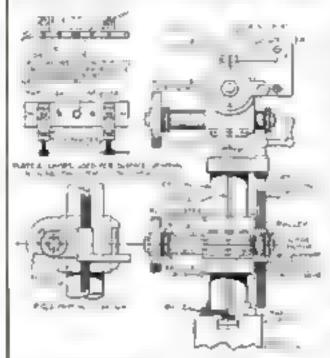
Printness Visioner consider Park Accompanies Arbung Ready until Audator Chemistra pher Pare murance Fapers. Sant are Fractions Master Planter Heinlind & Year Simplement Assemblish Children aufrigeriebt für geraft Bolb Airplane Mechanic Crederal Education Coupar Common school President

#### -\ddress.

#### Surface Grinder Lathe Attachment That Does Good Work

By H. H. Parker

HIS small lathe attachment will be found extremely useful for grinding various flat and cylindrical or disk-shaped articles, also, the grinding wheel and sleeve may be removed and a sleeve containing a drill chuck and pulley used in its place, or a plate holding one or two small vises may be clamped in place of the sleeve, in which case the device becomes a mill-



The diagrams show the various uses to which the apparatus may be put

ing attachment, the milk being held in the live center of the lathe.

A lew diagrams are shown suggesting various uses to which the apparatus may be put. In the original, a 16 horse power electric motor running at 1750 R. P. M. was used to drive the grinding wheel, the motor being holted to a hardwood base fastened to the adjustable slide of the apparatus Itself, making the whole self contained. A large hardwood drum pulley was attached to the motor chaft and belted to a smaller pulley on the grinder shaft, to give the wheel the nece a y high speed for grinding. If a surrar e motor was not at hand the device could be driven by a small round belt from an overhead countershaft, provided with a weight or some means for keeping the belt at constant ten-

The whole attachment can be, and the original was, built on a small lathe, which need not necessarily be of the screw cutting variety. Only one operation is not exactly in the line of lathe work, the cutting of the long keyway in the upright column, but this may be accomplished by turning the cutting tool over on its side and moving the slide rest along by hand, the action being similar to that of a shaper.

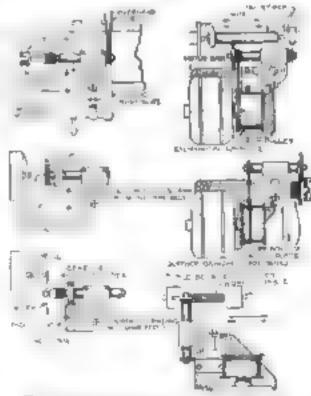
The machine consists of a steel or cust iron column drilled for a holding down bolt which clamps it to the tool alide of the lathe; a cast iron base is screwed to the bottom to increase the bearing surface. A split cast from slide works up and down on this column, being adjusted by the screw and handle shown and clamped in place by a clamping bolt through the split portion.

This slide (E, F, G, H), has a prosection on one side bored out to take a horizontal steel sleave and is aplit horizontally and provided with tightening acrews to clamp the gleave in any position. The opening for the sleeve may be drilled and then bored out to size by means of a boring bar between lathe centers, the slide being clamped to the column and the latter bolted to the tool slide during the operation.

A bronze bearing in each end of the sleave holds the grinding wheel shaft in position. It is best to drill and ream the sleeve, then machine the outside concentric with the bore and then insert the bushings and run a reamer through them, thus bringing them in line for the insertion of the shaft.

No dimensions are given, for the size of the apparatus would depend upon the lethe upon which it was to be used; but the proportions should be about as shown in the drawing.

Some nort of a table will be needed to hold the work for surface grinding and about the easiest way to make one would be to take a plece of cold rolled



The whole attachment can be built upon a small lathe, which need not necessarily be of the screw cutting variety

steel about three eighths thick, an inch and three eighths wide and as long as denred. Drill and tap a hole in the center to 16 in, by 20 in, and a series of smaller boles along the center bne for 10 by 24 machine acrews. Each end of the plate should be center drilled so that it may be held between



Warfstare Samphone Outli



Wastitzer Viella Outili

NEW plan. Wurlitzer, the largest general music house in the world, is offering the finest musical instruments with complete porties at factory price. With each instrument comes a hand-some currying case, all attachments and extra parts, music tack, in-struction book and book of mutical selections. This new plan gives you at a transcadous saving all the things that otherwise you would have so buy separately at regular prices.

# Complete Musical Outfits Sent On Tria

Any Wurlitzer Complete Musical Ourfit will be sent for a full week's free trial in your own home. Play the instrument as if it were your own. At the end of the week return the instrument and outlit at our expense if you wish.

#### Convenient Monthly Payments

If you decide to keep the instrument, you may pay the direct-from-manufacturer price in small monthly sums. A few cents a day will make one of these beautiful instruments and outfits your own.

These Complete Outlies are ready. Send for one on free trial. Mellophone Flute Mando n Banjo-Ukalala Hawaiian Vitolyti. Trap Drum Bugle Tenor Banjo Banjo Char Clarionet Fife Banjo- Benjo-Outear Viola Piccolo Guttar Mandolin Uketele Cello Searchoner Clarionet · Piccola

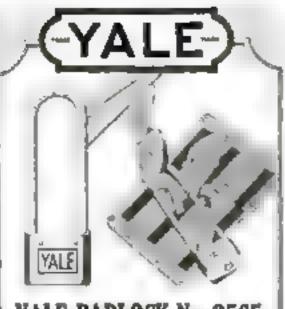


interested. Mail the coupon now. The Rudolph Wurktzer Co., Dept. 1203 117 E. och St. Cancinnett, O. - 329 S. Wilberth Ave., Cheeses. Ch.

The Rudolph Wurlitzer Co., Dept. 1202, 117 E. 4th St., Continues, O - 329 S. Walnut, Ave., Chicago, IL. Send me your new caralog with Illustrations in color and full description of the Wurlitzer Complete Outsits and details of the free trial and easy payment offer.

Name		 	impige.	-
Address	 	 		

et on onlich i am mjennelly emiprepied b



#### YALE PADLOCK No. 2565

If you own a Ford you will want this Yole Pudlock

NE, of the famous Your family of Padhotes. Nagon carolies Liber 1 bers. Locks Augent carolies Liber 1 bers. Locks and Placks But nest. Locks and Placks ware, etc. the store table 4t co. or or or or or or party.

W. h. he No. 365 you can be both perials, at it, uncruced, so that it one are remark the car three consenant the long on he's maked their share share but it was an he's maked to move and you will your own key which

dispain

On in your hardware dealer. And him to
show you the Yule No. 2144 Pudlock and
how convenies synthe efficiency think to
work. The Lanc mark Vale on A of a work. The transcenary Nate on A of a guarantee of the service but years of the service but years of the service but years own protection.

The Yale & Towns Mfg. Co. Makers of the Yate Lacks

7 East 40th Street, New York City

Chiman Hiller 17 East Jake 16

Complete Tale & Treater Utili-

When in Show York or Chinage, was over floating freeme. You will be secretable arrivated

Keep Take on all the new Inventions and dis-charges by subscribing to POPULAR SCIENCE MONTHLY



#### Never Had a Runaway

Garco makes your double six as dependable as "old Dobbin". You may be cutting along like a sub chaser, but your car is always under control. You can come to a standstill in the shortest kind of time.

Tough, long wearing, sure gripping auggests the sort of service you will get from Garco Asbestos Brake Lining.

Your doubt has it at can get it for you.

General Asbestos & Rubbar Co. Charleston, S. C.

CHICAGO

PUTTSBURGH

NEW YORK

lathe centers; this method will be found to hold the cable firmly enough for any of the grinding operations which might be performed upon it. The work could be acrewed or clamped to the table, but the best way would be to procure a couple of small vises or clamps and screw these to the table and clamp the work in them.

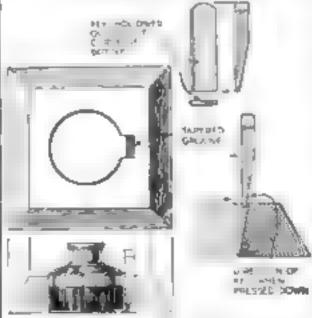
To use the attachment as a milling device, with the milling cutters held in the lathe chuck, screw a short mandrel of the same diameter as the grinding wheel sleeve into the shove described surface grinding table and clamp the mandrel into the slide after removing the grinding wheel and sleeve. Now we have an adjustable milling vise to hold the work while it is operated on by the cutter in the live center.

In using this lathe attachment it wall be noticed that two of the necessary adjustments, namely, longitudinal and transverse, are provided by the apron and tool slide of the lathe itself, while the remaining or up-and-down adjustment is actuated by the handle and screw working through the slide on the column.-H. H. PARKER.

#### An Ink-Bottle Holder that Won't Upset

VERY draftsman knows how often the ink is upact while he is working A stand to keep the ink-hottle steady may be made from two small pleces of hard wood.

The base is a block of hard wood 4 in. by 4 in. thick. The hole to receive the bottle in the base is bored a little bit larger than the diameter of



The ink bottle that will not upset proves a boon to the draftsman or artist. It is easily made

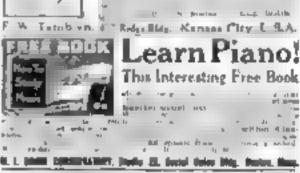
the bottle; this is done with an expansive auger wood-bit.

The wood key or wedge must be tapered and the flat side facing the bottle must be hollowed out to fit the curve of the bottle.

The groove in the block is cut so that it will taper to correspond with the angle of the keys, thus, when the key is pressed down, it will wedge the bottle and keep it from dropping through the base.

The stand may be finished with a stain and polish.-M. Tocaben.





#### BUCHSTEIN'S FIBRE LIMB



#### 

Robitmon Folding Bath Tub. Big He for Couts lattle no planting. heale water Weight 15 popula-toble sale ame on Full length hatter for then tun father for the offer \$10 a day ransiy made. Weste for free tub offer

ROBINSON CABINET MFG. CO.

El54 Fantaries Building, Tolede, O.

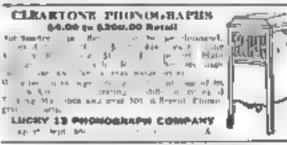


#### MASONIC BOOKS Jewelry and Goods

Soud for a Complete Laterague of

REDDING & CO.

Philaders and Mynufarturers Dept. S 200 Fifth Avenue New York



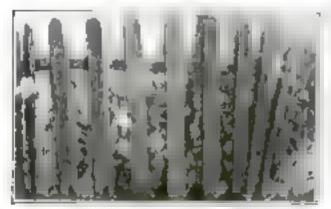
#### BOUND VOLUMES POPULAR SCIENCE MONTHLY

The most interesting and valuable book you can obtain in a bound volume of POPULAR Schesca Mosmar. It is a honory of the World's progress in picture and text. Each volume contains over 2,000 pictures, over 1,300 new articles, bandsomely printed in a big book of 960 pages.

Volumes now available are as follows Vol. 88, January-June, 1910; Vol. 91, July-December, 1917, Vol. 92. January-June, 1918, Vol. 83, July December, 1918, Vol. 94, January-June, 1919. Price per bound volume, postpard, \$2.50.

#### Wagon Felloe Makes Round Fence Corners

EVERY farm has several old wagon wheels lying about. They can be used to make round corners for picket



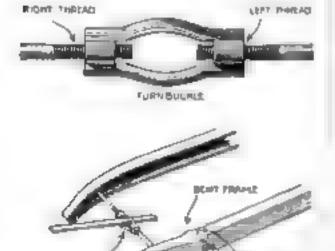
improve those staggering fence corners by attaching a wheel felice which rounds gracefully

fences and this will greatly improve the appearance of the fence.

The wheel is first sawed at one point, then the spokes and bub removed. The fellow is next measured on the contemplated corner and the surplus material removed. Then the pickets are nailed on in the usual manner, completing a next and easy repair,—Cora Hamilton.

#### How To Straighten a Bent Automobile Frame

IT is not a difficult task to straighten a bent chassis framing, and very few tools are required. The necessary force can be provided with an ordinary turnbuckle, as indicated in the illustration. Various forms of jacks can also be used for the purpose, but the turnbuckle is the favorite of at least one repairman, who has applied it on



A bent framing can be readily straightened by means of a gasoline torch and tumbuckle

PURPLEUCALE

APPRY WEAT WERE

so many occasions that he has become an expert

The heat from an ordinary gasoline torch is sufficient to soften the metal to the point of bending under the stress of the turnbuckie. Even a comparatively small torch can be used, as the idea is not to melt the steel but merely to reduce the bending point, and this is accomplished long before the melting temperature is reached.



#### by the Rahe Practical Method In 6 to 8 Weeks

You'll learn best and quickest here in the Oldest and Greatest School of the kind in America. The Rahe method is the original practical method of training for success in the Automobile and Tractor business. More than 22,000 graduates owe their good success to the practical training they got here.

#### Earn \$150 to \$400 a Month

Garages and repair shops the country over know the higher skill and better ability of Rabe trained men—as a result, we always have more calls for men than we can supply. A few short weeks here will studie you to earn \$150 to \$400 a month immediately upon leaving school, or fit you to open a business of your own and make much more.

# Rane Autos School World's Oldest and Greatest

Twice more equipment and twice more floor space used in actual daily practice than in any other auto and tractor school. You will find everything in the automotive industry here—autos, trucks, tructors—all kinds and sizes, electrical starting, lighting and ignition systems—all types. Largest and best arranged live motor department in America. Master Mechanic instructors guide you in making quick progress.

#### You Learn Best and Quickest Here

Any ram 16 years and older can learn betweently. No previous experience or special advention needed. Come to this achool of granter equipment with samply the will to work. No tortest extract to buy fainter method meet during the war to train 1,000 soldier methodics in 66-day oursees.

Low Taition Rate Nove Fond your name to we can brail Free to you, not big Spare book out present Special Tuition Offer and proof from thousands of graduates.

#### RAHE AUTO & TRACTOR SCHOOL DEPT. 2149 KANSAS CITY, MO.

Two Blacks to your left on your come sed of the Chains Depart.

Name
Address



Mail this coupen today for Special Tuition Offer with the page Book showing opposituation everywhere and proof of gradue FREE of success,

.... Occupation





As an or pushions now open a finen women not to be agen? You shall have a to be mere average \$ 75 a in note which a make remark an inclusion of the pushion of the pushion

Soul party to free free, "Wireless the Squartsoits of Todos." freed Ratio Instincts, Book. 160, 14th & U.Sn. Washington, R. C.

#### AGENTS: \$2 an Hour

For Your Space Time Taking Orders for New Kurosena Coal Oil Burner Makes any store a ma store Borne and the co

Makes any store a ma store Borne at the gas. Chesport the known, Nordier, delice is brouding.



This new invention is a wonderful memory-maker for apenia, Allow hald 12 to one day Mills new time query time in the \$1 first in a day and a half. The latest price of road backers this Parser sell everywhere. Write quiet for agency and except.

Thomas Burner Co. 1267 Gay St. Dayton, Olin.

# EARN ENGINEERING

Fuper ever out engineers are being para sales long cateriors. The gray pro-present and there age training spectrum technical accurace 3 ment to to 2 years under copied engineers in electricity attend as another another can being dears on electricity attend as invocatory and despress phases. Hat a trade action. Training is condeposed if a next time is implied come to the Finlay Engineering College so, y not of its land in the Best Lay and high received which any time is the First entires ages earl which any time is the felt of the Engineer ages earl which the training training to the felt causes ages earl which the training to the felt of the Engineer ages earl which the training to the felt of the Engineer ages earl which the training to the felt of th



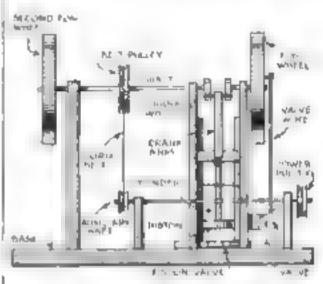
WRITE TODAY FOR BLUSTRATED CIRCULAR Explanming Try Sefere Visio Ray Plan RARRY A. SMITH, 38-70 Rock Vol. 2. Chap. S.

#### This Toy Steam Engine Gives Valuable Instruction

A MINIATURE steam engine that will give the builder a great deal of satisfaction can be made by using a bicycle pump as a cylinder and constructing the parts mostly of wood

On a base of wood three upright posts are secured by means of screws. Each of these posts is 18 in, long and 2 in, wide by 1 in, thick. The two posts near each other and on one side of the base are 2 in, apart, while the third is located in line with the others but 12 in, away.

Between the two posts the cylinder is located. This may be made from an old bicycle pump housed in a wooden block 2 in, square at the ends and 6 in, long. The original piston of the pump is left in place. Across the



Made from pieces of wood, wire and an old bleyele pump this toy turnisture steam engine offers first rate instruction for the youngster

lower end of the cylinder a brass pipe is soldered to hold the valve that admits and cuts off the steam, this being a single action engine. This pipe should be 's in, in diameter and 4 in, long. Near its middle a hole is punched and this hole placed over the lower end of the cylinder, in which position the two are soldered together.

The crank arm is secured to the upper end of the platon rod by a piece that works up and down between the posts in grooves purposely cut for it. The crank wheels hold the upper end of the crank arm between them, a wire 3 in, from the circumference of each passing through the end of the arm

The two flywheels are cut from inch lumber with a compass saw and should measure 12 in, in diameter. The crank wheels are 4 in, and cut from inch lumber of some hardwood variety. Holes near the top of the three posts act as bearings for the shaft and a cord belt is used to connect the shaft with the auxiliary shaft. Upon this second shaft the belt pulley is located.

The valve that allows the steam to enter the cylinder is made from a V-shaped piece of hardwood pivoted to the post as shown in the diagram. A wire from the flywheel operates this arm when the wheel rotates so that the valve is opened and closed. A

small piston valve located in the pipe that was soldered to the base of the cylinder is also connected by a wire to the valve piece. As the wheel rotates it will cause the valve piston to move back and forth across the entrance into the steam cylinder. By timing the valve a position may easily be found where the steam will be allowed to enter the cylinder just as the puston starts upward and will also be cut off just as the picton starts downward.

Compressed air can be used as well as steam for the operation of the engine. Its originator soldered the head in a milk can and built this into the

arch to form his boiler.

#### To Reclaim Kitchen Knives that are Handleless

IN almost every household there are knives that have lost their handies and yet are beloved of the house-



Overcome the H. C. of L. in the kitchen by supplying old knives with new handles keeper because of some peculiarity in the blade or other feature. Also in every household there are clotheaping An Ingenious housewife has found that by cutting off the prongs of a clothespin about an eighth

of an inch shorter than the tang of the kulfe-blade, winding over the slotted part with cord or, better yet, wire, and filling the space around the tang with melted sealing-wax or melted rosin, the good old blade can be given a new

lease of life.

The object of cutting off the legs of the pin is to allow the point of the tang to be slightly driven into the wood in the crotch. A handle made in this way is surprisingly comfortable and convenient to work with. - HOWARD GREENE.

#### To Get the Most Out of Rubber Tubing

THEN a rubber tube gets a hole or two in it, don't throw it away. Buy a piece of glass tube at

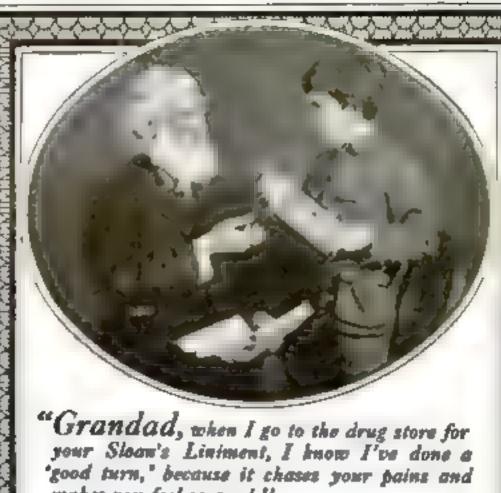


GLASS TUBE INSCRECE

Don't throw that leaky rubber tubing away. Make it as good as new with glass tubing the drug store. Cut the rubber at the spot where it leaks and insert a small piece of the glass tube, and, presto your tubing is as good as new.

The **R** 488 tube may be

easily broken into sections by cutting notches in it with an old knufe and ther suspping the tube between the fingers.-A. B. WEGENER.



makes you feel so good."

"GOOD TURN" in A thousands of households to producing a bottle of Steam's Liniment when

Kept handy, it quickly rehoves all external pains and aches, producing a warm tingle of comfort and relief.

Sloan's Linkment has stood paramount for thirty-night yours as a reliable, effective allayer of Rhoumatic Twinges, the sharp pange of Sciatica, the aches and pains of Lumbago, Neuralga. Sore Muncton, Staff Jointa.

Penetretes without rubbing, does not stain the skin, takes but little to produce most gratifying results.

Keep a bottle handy. Three sizes-35c, 70c, \$1.40. All

# Sloan's World's









a Gallon of Gasoline!

#### The Shaw Motorbicycle,

A high-grade, easy running, speedy motorsiepele of dependable power at a saving of from a third to a half in artual re-new Equipped with 212 R-P of tox, famous Resear. carborevor high tension magnetic. Automatic control at all times. Thousands in unit, the Shaw Attachment this any old take,

SHAW MANUFACTURING CO. Dept. 211 GALESBURG, KARS.



IITING-ADAMS

Recommended by All who use them Sold everywhere

There are paveral million persons in the United Status continually using Whiting-Adams Brushes.

Sond for Mustrated Literature

JOHN L. WHITING-J. J. ADAMS CQ. Besten, U. S. A.

Brush Manufacturers for Over 109 Years and the Largest in the World

# Mother Pins Her Faith to Musterole

In days gone by, mother mixed a mustard plaster when father had bronchitis or brother had the croup, but now she uses Musterole. It is better than a mustard plaster.

She just rube it on the congested spot. Instantly a peculiar penetrating heat begins its work of healing—and without fuss, or muss or bluter.

Musterale relieves without dis-

The clean white clutment set your skin a-tingle. First, you feel a glowing warmth, then a picasant lasting coolness, but way down underneath the coolness, old Nature is using that peculiar heat to desperse congestion and send the pain away.

Made of oil of mustard and a few home simples, Musterole is uncommonly effective in treatment of the family's little life. It takes the ache out of grandfather's back. It souther alster's headache, it helps mother's neuralgia.

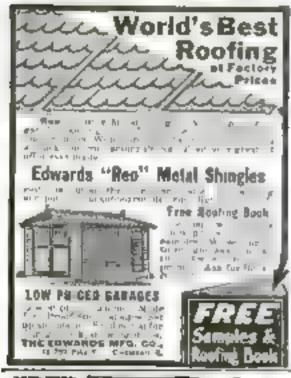
Mother pine her faith to it us a cent "first sid."

She is never without a jar of Musterole in the house.

Many doctors and purses recommend it. 30c and 60c Jars, hospital and \$2.50. The Musterole Co., Cleveland, Ohio

BETTER THAN A MUSTARD PLASTER





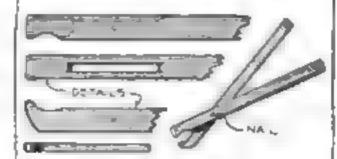


Cut cut this ad and small it to us, with your same and address (no moresy) and the trill prod just our FAWORD EARMAN MALON by return man), partyped. You set you the many day 30 that I fittle, then if you like it, pay no it. If you should like it return it. Supplement them. If you had he is.

#### Tool for Handling Fuses for Heavy Voltage Currents

LINEMEN and electricians who have occasion to remove or install fuses in high tension lines will appreciate the little tool described below. This tool is simple and may be the means of preventing a severe burn or shock as a result of coming in contact with five wiring.

Cut off a section of broomstick about a foot long and saw a slot near



There is no possibility of a shock when handling high troltage wires if these tangs are used

one and about six inches long. Drill a small hole through toe stick at right angles to the slot and about halfway down its length. The slot should be at least one half inch wide.

Next cut out a piece of hard wood the shape indicated in the illustration and fit into the alot, driving a neal through it and the holes in the broomstick so the combination will work like a pair of scissors.

Souk in melted paraffin and it is ready for use.

The fuse can be grabbed up with the aid of this tool without the least danger.—THORNTON HALLET.

#### Remember This When Your Automobile Won't Go

THE greatest difficulty the trouble locater has to face is taking things for granted.

All of you know that it is impossible to start a car with the switch in the "off" position, and yet it is a daily occurrence to see men try to crank a car without first throwing on the switch. Recently we saw a man crank his car for twenty manutes with the switch off. The ignition switch was set in the center of the lighting switch handle. Therefore the absolute position of the switch key varied according to what lights were on-hence his mistake; yet this man looked all over his engine before he discovered the trouble. Being absent-minded probably had something to do with it.

The other day we started to take a ride in the country and after we got a few miles out our engine stopped dead. I began to figure all sorts of things. We had filled the tank with gasoline and had taken plenty of oil, so we knew this could not be the trouble. If I had been driving that car alone, I venture to state I would have been there indefinitely as I could not see what was the matter with the

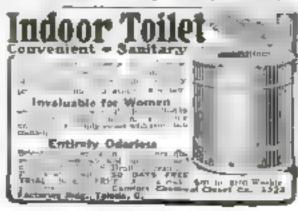
# Learn Tree Surgery

The one real profession that is not overcrowded

Hea third, (ascinating audpay work on America stricks, a more existent, travel with early entire or and good managers at he start and a oig chance for advancement a digotiled and actentic protession that commands the respect of every rody - this is the opportunity offered your as a Datest Tree Surgeon. Write for details of our plan to train your at home in your spare one or at our head-quotters in Kent and give you get a failor, the largest and one acceptability, agest if to E professed. The in a Tree Papert Co. Inc., 25 King Street, Ken, Oplo.

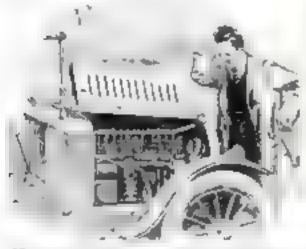






"durned" thing. But the fellow driving the car was an old time motorest, and immediately asked his wife for a hairpin. He crawled under the car and found that the gasoline feed pipe was choked with a piece of rubber from the gasoline hose. In a couple of minutes we were under way

An automobilist who had just had the valves ground, found that the compression in the first cylinder was weak. He removed the exhaust valve but found it in perfect condition. He then took out the intake valve but found that too in perfect condition, The difficulty did not seem to be due to too small a clearance between the valve stems and push rods, because the clearance was the prescribed amount on both the intake and exhauat valves. He concluded that it must be the piston rings which might be either gummed or broken. Flooding the cylinder with kerosens did not improve the condition, so a pint of very heavy oil was put in with the idea that this would temporarily stop any leaks between cylinder and platon, but still the compression was no better. Several times he was tempted to increase the clearance between valve stems and push rods, for no sensible



Numerous accidents happen through thinking the car is in order. Never take things for granted if you own an automobile

reason, because the clearance was correct, but simply in desperation. It seemed about the only thing left to do-it was the only thing he had not tried. But his common sense said no, so he took his car to the local garage. The first thing they did was to increase the clearance on the Intake valve, and the trouble was cured. The reason for doing this was that there was a high spot on the back of the intake cam which would open the valve a slight amount on the compression stroke. The clearance was increased to a point where the high spot had no

These various incidents prove that it is unwise to take things for granted. It is also important to bear in mind that it is not wise to use too much logic in trouble hunting, for the solution is often far from logical. It is a good thing to reason as carefully as possible but if the solution is still to be found it often happens that it is obtained by some illogical act.











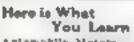
# LEARN AT HOME

You don't have to go away to school to become an Automobile or Tractor Expert. Learn right at home-in your spare time at less than one-tenth the cost

There are thousands of big jobs open to men who know penething about automobiles and tractors. Ten times the number now engaged in the business are needed. You can fit yourself to hold one of these fine jobs without leaving home-you keep right on with your present work-keep on carning while you learn. Here's your chance to land one of these regular man's size jobs paying you from \$40,00 to \$150,00 a week,

# **Auto Books** and Tractor Information

15 givest experts wrote this fine home study course on Auto and Tenctor Engineering just for men like your. They teach a even think has the best and elected cards. You can't saw many distinct these and enterthing to age there are the transmission of a go there are marked of a critical transmission of the report to the pages of advanced monocentaling lasts. Over some as exact actions every hung as plant as a . If a house an more base seed near such and burn made good. A hundred are making good revery day. I so an easily good too.



Automobile Metalia Marting Shar or spin which he departs that the state of the first own metalian has been a safe from the first own metalian between the first own metalian between from the first own fro

128 Blueprints of Electric Wiring Diagrams

# FREE

We will send a set of these erest Auto and Tractor Books to the set a week a reaction by Money down I so at such the coupon below and mail it. The sake will come at once by parcel part or ear one will make it. The sake will come at once by parcel part or ear one will make it. I say our wants after a set of sake of the sake of th for yourself for a sign but to he po 41 a week A and send of the feet with send of the many of the ma He in of the life in the life The gare provided to This special rate of the special rate of the

## Mail Coupon

This coupon is not an order It is not a remark or for r ?
It grove not be not been what who go
he are a not to be not read on
he we are a set of the respect.

For our remarks.



Dept. A- 202, CHICAGO

Firs elsewise a six volume set of Automobile and Tractor information by parcel type, or any the same days, trial and handrage I will either send you \$2 So on an week, and \$2 to a money until I have paid \$21.80 or notify you that I don't want the hooks so you can send for them at your own expense. If the books are sent back I am not under any obligations and won't owe you anything.

Address.

Reference

Please give name of local merchant, hanker or mail order house on last line.



### Brave but Helpless

railed upon to night to defend a nived of remote day the art. The main in the fine let up to be the form true les esses es awee le sona lors de la bro-pole des Tourises aver a la kellon a dazle, la sel Surpon des les lorges lorgendonnes : a high Pr In otto

Y a release a mean of the pain does became home. Where he does not the more than the large and the health in a size for a few points of the health in a size for a few points of the health in the hea

From the new has in various in these who hash in you be protection it is a set of the set of a william by above a play a make a pair. There we have a that the long of their minimum be more in terms to become their quest. For the part of the set of the s

when we arrow the few bing respective for times of bounding by parts to the transfer of the transfer of the time. The first time that the few few first transfer is the time. The first time appear to the few first times are the first time appeared to the few first times are the first printer of the first time are first times. The first printer of the first times are first times are first times are times and the first times are times as the first times are times as the first times are times and the first times are times and the first times are times as the first times are times and the first times are times and the first times are times as the first times are times and the first times are times and times to time times are times and times times are times and times times are times and times are times are times and times are times are times and times are times are times are times are times and times are ti

It is 8- or many framework your bears have to quagram an appearant It is the the term of the proof of the term of the proof of the term of term of the term of term of the term of the term of the term of term o

Fig. 4. In ... 8. assumble to immension to Marchael Stallman drives. A temperature or sage to section

is fare. We now will be immercial for Marchaell Millemon.

The operation cape is replied.

O testinate is start, from a gluent, dash a charactermod.

In the control of the cape is a significant of the position of the cape you, he constitutes it the law position of the cape you, he constitutes it the law position of the cape you, he constitutes it the cape to the first of the cape of the

The transition of all the right of the transition of the transitio

#### menseemFree Trial Coupon

them that the second of the se

MARK A SEE HAN A OR K. O. South for the South of South of the

View may now the conspicts Marchall 20-30 on consectioning with self-state expends the set of the principle of the principle

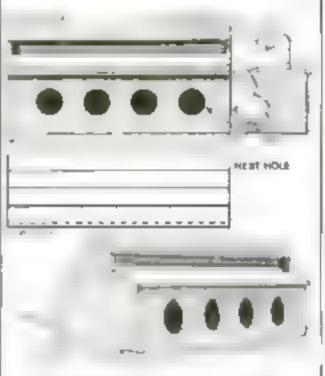


#### Combination Feed Hopper and Nests

HE accompanying sketch illustrates a combination feed hopper and nest boxes which have proved an ideal combination.

The feed trough was built of wood with a metal partition, as indicated, suspended from between the cover boards to within about 3 in. of the bottom of the trough. This trough was about 2 in, deep and 10 in, wide and 5 ft. long.

Then a nest house was constructed, as shown, 5 ft. long, 2 ft. wide and 2 ft.



Combining the feed hopper and poultry nests enables the hous to feed out of the trough without crowding each other

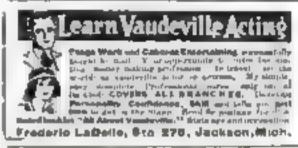
high. A notch to accommodate the trough was cut in each end board and the trough set in. Then the top hoards of the nests were put in place on a slight pitch as shown. Nests were partitioned off separately and the entrances were in circular form, the bottom edges being about 10 in. from the floor so straw could not be scratched out.

The hers are compelled to stand on the roof boards of the nests to feed out of the trough but cannot crowd owing to the slant of the roof. They also cannot get into the trough because of the tin partition, but still can eat without spilling or throwing out the contents.-TRORNTON HALLETT

#### Adjusting the Electric Light at Will

EEPING the light at exactly the In right height, whatever the nature of the work, is an easy matter for a certain clever mechanic. Overbead behas fastened a curtain roller to which is attached a string with a loop at the free end. Through this loop the cord with the electric light is passed. Whenever the light is needed closer to the work, he simply unrolls the string until the illumination is satisfactory Raising the light is as easy as rassing a window curtain.-FRED TRLPORD.







#### "BOW LEGS and KNOCK-KNEES UNSIGHTLY SEND FOR SOCKLET SHOWING PHOTOS OF MEN WITH AND WITHOUT The Perfect Leg Forms

PERFECT SALES OB., 140 W. Mayfield Arts., Dupt. 45, Chicago, LL.



#### HANDY ATLAS OF THE WORLD

Leater from brand new plates with highern t stork Water in being Voluntains treher and as Raptones hanged. Shows early State of the Lar I States as the Frace, a of Canada and the Contraints of the World, Price in Cloth, \$1.00 and in Leather, \$1.50. Postage, 10 cents, Book Department

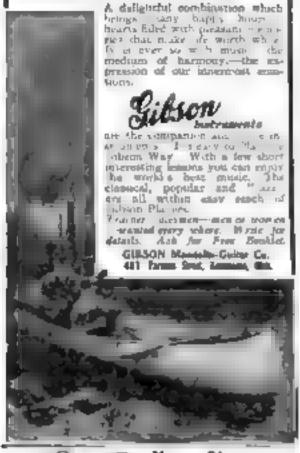
Papellar Science Monthly, 225 West 19th St., New York

Suilding and Flying an Auropians-A practical handbook covering the design. construction and operation of aeroplanes and gliders. Cloth 150 pages, 80 illustrations. Price, \$1.00 postpaid.

Harper's Aircraft Book-Why aeroplanes fly, how to make models, and all about atternit little and hig. It explans in a comple, lucid manner the principles and mechanism involved in human flight, and tells how to design and construct model aeroplanes, gliders, and mancarrying machines. \$45 pages. Illustrated Price \$1.10 Postpaid.

POPULAR SCIENCE MONTHLY 225 West 39th Street, New York, N. Y.

#### Companionship and Music



#### Your Chance to Make Big Profits in Yulcanizing

There is your chance to get than a techny productive bond, pear which will make pirel in direction. Sell have such a sell of the Anthorough school before and towards and the least open and the sell may retreated and towards and the last open Anthorough the last open Anthorough the last open Anthorough the last open Anthorough the last open and market product and the last open and the last open and a last to the last open and the last open and a last to the last open and a last to the last open and the last

Without the party state of the party of the A.



#### 10 Cents a Day Pays for This Symphonola

Many all systems Yester Colombia, Killiam Pathe, I rate Wester. Kongram, Take a seed in pay of left fill these is all it come.

Symphonols Records Garage and Consequent Symphonols Book Fel EE

Symphonols Records Garage will be the selection of the selec

Lurkin Co. De SPSH IN Buffelo, N. T.

#### Wrestling Book FREE



Prints Gotch and Parmer Burns of ry you want to be a state of the part of the

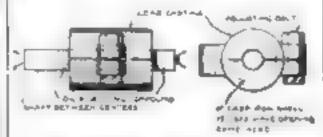
#### Lead Lap for Finishing Shafts to Size

O make the lap a lead casting is required about the proportions shown in the drawing, east in a wooden or plaster-of paris mold. This may either be drilled out afterwards or a steel rod about five thousandths of an inch smaller than the required shaft diameter may be placed in the mold and the lead run around it, after which it may be driven out and the hole reamed.

A piece of thick pasteboard may be set in the mold where the lap is split; this will save sawing afterwards.

A hand reamer is then run through the hole taking great care that it does not cut the hole "bell mouthed." This may be prevented by having the hole nearly to give before reaming so that there will not be much material to remove and then being careful not to apply side pressure to the reamer.

A holt is put through one of the lugs to close the lap slightly, though thus



This time-saving lap will polish the surface, smooth off eccentricates and brang the shaft to sare from end to end

adjustment should not amount to more than two thousandths. The opposite lug is merely to balance the

A better construction would be to make a split cast from shell and run the lead into it; the center opening of such a shell would be about where the dotted lines are shown in the drawing. In this case a number of lead castings with different sized holes could be made to fit into the iron casting, provided the opening in it was smoothly bored out.

If the reader has not access to a foundry or cannot do the machine work required for the iron casting, a plain lead casting as described above will give satisfactory results.

To use the lap, finish the shaft as nearly as possible to required dimensions, as mentioned above, then smear the lap and also the shaft with oil and emery or valve grinding compound. Rotate the shaft rapidly in the lather moving the lap back and forth and also rotating it by hand (to prevent sts being worn one sided), tightening the adjusting bolt from time to time, if necessary, but very slightly, and (requently stopping the lathe, wiping off the shaft and measuring it. A contrivance of this sort will soon pay its original cost in a bundred ways and it will be invaluable to the mechanic. It occupies but little space when it is not being used. - H. H. PARKER.



# **\$95** an Hour!

"Every hour I spent on my L. C. S. Course has been worth \$15 to me! My position, my \$5,000 a year income, my nome, my family's happiness— I owe it all to my spare time training with the International Correspondence Schools

Every mail brings letters from some of the two militon I. C. S. students telling of promotions or increases in salary as the rewards of spare time study.

What are you doing with the hours after suppor? Can you afford to let them alip by unimproved when you can easily make them mean so much? One hour a day spent with the 1 C. S. will prepare you for the position you want in the work you like best,

Yes, it will? Two million have proved it. For 28 years men in offices, stores, shops, factories, mines, railroads in every line of technica, and commercial work—have been winning promotion and increased anames through the 1 C. B. More than 100,000 men and women are getting ready right now with the L. C. S. help for the bigger jobs ahead.

#### Your Chance is Here!

No matter were you live the L C S, will come to you. No matter what your bandscale, or how small year means, we have a plan to meel your circum stances. No shaller below imited your previous ed acation, the simply written, wanderbusy facustreted I. C. S. tertbooks make it easy to learn. No matter what career you may choose, some one of the 200 L. C. d. Courses will annuly said your moods.

When everything has been made may for you trhen one hour a day open w h the I ( A. in the que of your own home will bring you a blager tocome, more comforts, more pressures, all that sprees meant-en you let another single pries-less hour of apare time go to waste? Make your start right now! This is no we ask Without cost, without chingsting yourse I in any way put it ap to as to prove how we can help you. Just mark and man this coupon.

INTERNATIONAL CORRESPONDENCE SCHOOLS BOX 7665, SCRANTON, PA.

southeast abligating me. how I can qualify for the
or in the subject, before which? much A.

abres attent abridation
ownes, or in the subject.
THE RESTAURANT OF STREET
Electric Identifies and Byt-
? stepraph Faginess
Tataphintes Biert
MI PATRICIPAL PROPERTY.
Berkneicht Profitmbie
I niegouph Fraginish. Tutophisto Petrk q principle in saveling. Bothorish Profunds Quitte Shap Joyating. Tuolinakar
Tuplmaker
CIVIL ENGINEER
CIVIL DOCTORELR
m on return and marging
B OF PRINCIPLE OF PARTY
日本大学2 ()日本開催   日間()日本版画的
NAT THE STATE OF THE SAME STATE OF THE SAME SAME SAME SAME SAME SAME SAME SAM
Sarp Deplemen
ARCHITECT
Total translated and Bullidge
hephiopelarus brudinging
Concrete Builder
For round Engineer
PROPERTY AND ADDRESS OF TAXABLE
institucted and Station in the August Station of the Station of th
Torkby Drawquet or Page.
CHRIST

THALESMANSHIP	
ADVIXTISING	
Window Triggment	
Shum Lord Weller	
Man Palater	
Bullemed Crain Blat.	
LUSTRATING	
Caringples	
1 1. ESMANNIP ADVINTING Window Trimmer Show Lard Weller Was Pointer Helicand Communic LUSTRATING Carrosping HEMANNING MASSAULTER Private Secretary	
Private Secretary	
HOOLEFEPER	
Strongyupher and Trains	
Jerr Full Accommission	
TRAFFIC MANAGER	
Rallway Accountrat	
Commercial L4=	
GOOD ENGLISH	
Leacher	
Commerc School Polificate	
CONTRACTOR	
Rollway Mail Clark	
TELEGRAPHIC CHAPTERS	ı
I ate Repairing	
Newlgaring Promis	Ì
ROOKEREEM Researcher and Tryink Ler Fuh Accountant INAFFIC MANAGER Reliver Accountant Commercial Les GOOD EVELUM Leacher Commer School Soldinia City II. \$25 Vic E Relivery Mail Clark Accountage or blacker Link School Soldinia City III. \$25 Vic E Relivery Mail Clark Accountage Or blacker Link School Soldinia Link School School Soldinia Link Sch	

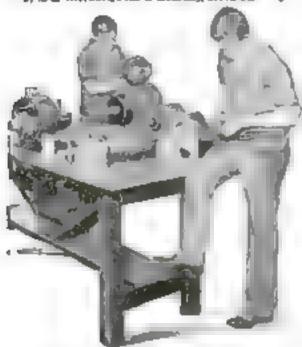
Name	 	_
Trepept Cenunalism		
Street und Ma	 _	

Allaka. Canadians may read from vector to 7-18-4

#### Construction of

#### Small Alternating Current Motors

by A. E. WATSON, Prof. of Electricity, Se-



This book contains complete tostructions for buskling small alternating current motors in several sizes. The designs will be found in harmony with those of the very best manufacturers and they can be worked out by the amateur for making useful instruments

Some of the subsets, also up are. Character it is bouldress or hiterna my Corrent Mapower, Smale Phase Induction Motor, Procedure in Tenting and Lung on Alter nating Current Generator or Synchronous Motor," Clear, concise directions and care ful drawings are features of this book

Faily illustrated. Price, prespeed, \$1.25

#### Twentieth Century Book of Recipes, Formulas, and Processes

Maked by GARDNER D. HISCOT, Rt. E.

The most valuable techno-chemic d formulæ book published, including over 10,000 selected scientific, chemical, technological and practical recipes and processes. This book of 800 pages, gives thousands of recipes for the manufacture of valuable artiries for everyday use. Hints, helps, practical ideas and secret processes are revealed within its pages. covers every branch of the useful arts and tells thousands of ways of making money

The pages are filed with matters of immeasurable, practical value to the photographer, the perfumer, the painter, the manufacturer of glues, pastes, cements and macrages, the physician, the druggest, the electrician, the brews, the engineer, the foundryman, the machinut, the potter the tanner, the confectioner, the chiropodist, the manufacturer of chemical govelnes and toilet preparations, the dyer, the electroplater, the enameler the engraver, the provisioner, the glass worker, the goldbeater, the watchmaker and jeweler, the ink manufacturer the optirian, the larmer the dairyman, the paper maker, the metal worker the man maker the veterinary surgeon, and the technologist in general. Contains an immense number of formulas that everyone ought to have that are not found in any other work. New edition. Cloth binding. Price, postpard, \$4.00.

Bank Dept. POPULAR SCIENCE MONTHLY 225 Want 39th St., New York

#### How to Construct an Electric Vulcanizer

By C. L. Smith

PHIS vulcanizer is designed for 110 volts A.C. or D.C., and has an automatic heat-controlling thermostat. It consists properly of three units: the beating unit, the control unit, and the clamping unit, all of which can be made for a very small cash outlay plus a little spare time

To build the heating unit, procure a strip of light sheet-iron or heavy tin, 9 😼 by 6 in., and bend it into an L shape, making the stem of the L 41, th. high and the base 4 in. wide. Cut three strips of asbestos 6 by 8 in., 1/4 by 514 in., and 334 by 531 in. respectively. The 354 by 6 % strip is to be used for

the heating coil. On this strip wind about 110 ft. of No. 22 fron wire (or resistance wire of 110 ohms resistance), being careful that the successive layers of wire do not touch each other and cause a short circuit. Then place the



This device urt up and attached to the tube

strip up slightly so that it will clear the metal of the instrument except at the place riveted, but yet lie paradel to it. Take a strip 16 by 116 in. long and bend it as shown in the sketch, and fasten it to the vulcanizer, using asbestos to instrate it. Lead a wire

> from this strip to the other binding post. Be sure that these blading-posts are insulated. Now provide an

adjusting screw.

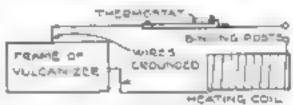
The thermostat will not operate upless the brass strip is on the top side, or on the side next to the adjusting screw. The screw regulates the heat of the vulcanizer. The proper temperature la 260° F

The vulcanizer is now complete. An ordinary hand clamp can be used to clamp it upon the inner tube. It will take about fifteen minutes to vulcanize a small patch and up to thirty minutes for a large patch.

By studying the diagrams no trouble should be experienced in making the apparatus. If it is made round instend of flat it can be adapted to casing repair work.

#### ADJUST NO SEREW. BRADS STR PS WHEE GROUNDED TO TON STEP VULCAN ZER PRAME FULCAMIZER PRANT

The thermostat will not function unless the brass strip is on the top side



A glance at the illustration will show the exceeding simplicity of the traction wiring

4 1/2 by 8 In. piece of aubestos over it so as completely to insulate the heating

75 - 24 } 34 + 55 V ASBESTOS STER SHEET RON BINDING. P0575 HEATING COIL

The heating coll and dimensions for cultury the asbettos strine unit from the metal of the vul-Now cantzer. bend the Lshaped piece of metal down over the coil. Bring out one wire of the coil to one of the bindingposts and ground the other to the frame.

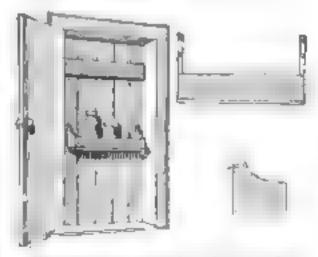
To construct the thermostat procure two strips of dissimilar metals firon and brass) 🍕 by 4 1/4 lin., and rivet. them together, placing the riveta

Min. apart. Rivet one end of this strip on top of the vulcanizer and bend the

#### Space Between Doors Acts as a Refrigerator

S a rule, in places where there are A no ice-chests or cooling devices, milk bottles and the like are placed on the floor near the door to keep them cool. They are thus often in the way and consequently are apt to become broken or spilled

One suburbanite solved the problem by attaching a little shelf, as il-



Why not attach a shelf to the storm door and eliminate the icc-box for the winter

histrated, to the inside of the storm door. Thus the food or liquid was always enclosed in a cold air space between the two doors, was out of the way, and was instantly accessible

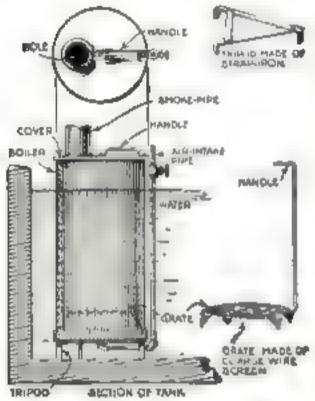
Spring clips inside the edge of the shelf kept the bottles from tumbling off when the door was opened quickly.-L. B. ROBBINS.

#### An Inexpensive Heater for Farm Watering Tanks

As an inexpensive though efficient substitute for the portable heaters now on the market to keep the water from freezing in watering tanks for farm stock, the following idea will prove of value.

Procure an old but tight hot water boiler and cut it down to a height which will allow it to project at least a foot shove the maximum water level in the tank. Plug up all side openings with regulation pipe plugs, threading in tight to prevent leakage.

Cut out a cover of sheet iron for the top and provide it with several lugs around the circumference to hold it



Here is a beater that is simply placed, in the water of one end of the tank, then a fire is built in it

snugly to the sides. One side of the cover is supplied with a hole for a small stove pips. This should have a colar to prevent its skpping down in the boiler. Attach a handle of strap iron to the opposite side of the cover.

The air intake is composed of piping, as shown, which is threaded into the hole in the bottom of the tank. If desired, a valve can be inserted in this pipe to regulate the supply of air.

As the intake pipe projects below the bottom of the tank, construct a tripod of strap iron like that shown in the sketch so the piping will just clear the tank bottom.

A grate is made by cutting out a square of heavy screen wire and bending down the corners so it will stand in the inside of the boner about 6 in. above the bottom. A stiff wire handle should be attached to lift the grate out when cleaning.

This heater is simply placed in the water at one end of the tank and a fire built on the grate of alow burning material which can be replenished at will by raising the cover. Draft, of course, is regulated by the valve in the intake pipe and a damper in the amoke pipe.—WINDSOR CROWELL.



YOU who appreciate fine workmanship will like the Harley-Davidson better the more closely you examine it.

You will see in the wonderful machine work and fitting, evident all through it, the underlying reason why this great motorcycle broke the Three-Flag record, Canada to Mexico, by over 5 hours, and clipped 10 hours from the New York to Chicago record.

# Harley-Davidson

is machined to closer limits in all running parts than the finest automobile built. In design and workmanship it is a recognized triumph in engineering. The Government, as well as America's experienced motorcyclists, look to Harley-Davidson as the acknowledged leader in motorcycle practice.

You will not be entisfied with anything less than the "World's Champton." It is usually the first choice, and always the final choice, of riders who know

Ask your Harley-Davidson dealer about his easy payment plan

#### Harley-Davidson Motor Company

Milwaukee, Wisconsin





# For the Radio Experimenter

#### Practical Operation of Thermionic Detectors

By H. J. van der Bijl, M. A., Ph. D.

NO piece of apparatus holds the attention of radio men or steadily as the thermionic delector. No matter what the name applied-whether "thermionic detector," "triode tube," "electron tube " or just plain "vacuum salse"—the applicance, out of all the radio experimenter's apparatus, is nearest and dearest to his heart. It can accomplish most of all.

Herewith we present an article on the practical manipulation of index by one of the country's leading authorities, Dr. H. J. van der Bijl of Now York City. It follows one in our October number. Benides these two articles on tubes as recrivers. Dr. van der Bift will shortly write three on tubes as amplifiers, socillators, and modulators. The series is attracting wide attention. Free discussions have proved so understandable, and yel so close to the core of the subject. The diagrams are very complets.-Entrog.

THE vacuum valve or thermionic detector has made it possible to detect, with a simple outfit. electromagnetic waves coming from considerable distances. It consists simply of an evacuated glass builb containing a filament which can be beated to incandescence, a pair of metallic plates and a pair of metallic grids placed between the filament and the

Instead plates. of plates a cylinder is sometimes used, in which case the "grid" takes the form of a hellx enclosing the filament.

When the filament is heated to a high temperature It emits electrons. If a positive potential is applied to the plate the electrong are drawn to the plate and so there is established a current through the tube. The magnitude of this current depends on the potential of the plate with respect to that of the filement. It can also be varied by varying the potential of the grid. Suppose the tube be connected in a circuit like that shown in Fig. 1 in which the plate is maintained at a constant positive potential with respect to the filament by the battery E<sub>p</sub>. Let us say that the negative end of the filament is grounded. Then if the

potential of the

grid be varied by aliding the contact a along the resistance / the variation in the plate current obtained can be represented by the curve abc of Fig. 2. When the grid potential is zero the current as measured by the meter A will be that given by the magnitude If the potential of the grid now be made negative with respect to the filament the grid would tend to repel

the electrons coming from the filament and drive them back to it. The plate, on the other hand, tends to pull them away from the filament, but on account of the opposite effect of the grid the current will now be less than when the grid was not at a negative potential. And so the plate current decreases as the negative grid potential is increased and finally becomes zero when the grid

> potential reaches the value given by oc. For lower plate potentials the curves do and will be obtained.

> > The fact that

the characteristic is not straight but curved maken it possible to use the device to detect electromagnetic waves. For suppose that the plate potential in much that for sero grid potential the current is that corresponding to the lowest curve. namely that given by the magnitude or. If now an alternating potential be impressed on the grid, as indicated by the wave curve below o, the current will be alternately increased and decreased as shown by the wave to the right of the curve. The input voltage, shown below o. is symmetrical. that is the positive and negative peaks are equal, and if it is a high frequency wave it will not be audible when passing through a tele-



What Radio Experimenter Couldn't Find a Use for These?

Interestant tubes in the collection of Dr. Lee Interestant takes in the collection of Dr. Let. Dr. F. organ at Ventus of the author o

an und mortd on terrelesters Georgia with the feet, 1906 F 1 v 1 v I to her m. Nevy need submireguary Bossom row (1) West for VT V 6 v Pl 40 ( 4d et de 1905) In at (Dr Forrer) F v Pl 40 ( 3d et de 1905) In at (Dr Forrer) F v Pl 40 v 300 Determinamenther oscillator (4) VT 21 (4gna) Corps deserter F 4 v Pl 440 (3) Navy detector nade flament F 6 v Pl 40

A op of page: Airphase radio apparatus as-sumbled for laboratory test. It ams many taken

phone receiver. The current wave in the plate circuit, on the other hand, has larger positive loops than negative. Such a wave consists of a number of component parts, one of which is a direct current, so that this wave will he indicated by a direct current measuring instrument. What this amounts to in the vacuum tube is that the normal plate current or will be increased as long as the incoming waves are impressed on the grid circuit of the



Airplane transmitting and receiving act, one detector, two amplifiers, a modulator Transmitting tubes are inside the coll merely to save space—important on sirplanes

tube. Now, if these waves are interrupted, say, a thousand times every second and a telephone receiver be included in the plate circuit, then the successive rushes of current through the receiver every thousandth of a second causes a note to be heard in

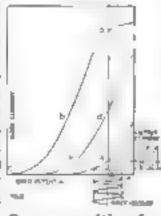
Circuit for obtaining characteristic curves of a vacuum tube

the receiver. The insudible high frequency waven are thus made audable.

A simple cizcult whereby this can be done is shown in Fig.

The circuit LC is tuned by varying the condenser C until it is in resobance with the antenna circuit A. This can readily be done by adjusting C until the tone in the receiver is of maximum loudness. The condenser

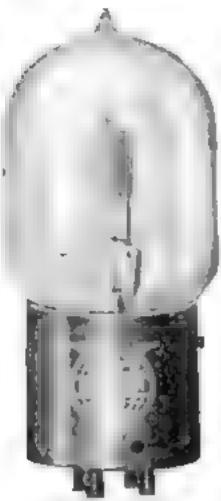
Co has a small empacity of about 500 micromerofarada. It acts as a by-pass to the high frequency components of the current in the plate circuit a but offers a high impedance to the audio frequency --current which =



must go through Curves resulting from the telephone re- the experimental circuit shown in Fig. 1

In order to obtain the best results it is necessary to adjust the plate voltage to its propor value. There is a part of the curve (Fig. 2) at which the rate of curvature is greatest. This is the part at which

# THE HEART OF THE WIRELESS



Fleming Pat. No 803881 De Forest Pat. Non 44 55' 879533

An Amateur Station Without a Vacuum Tube Is Years Behind the Times

# MARCONI V.T. \$7.00 each

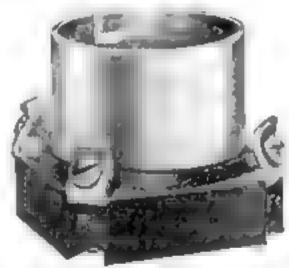
Under agreements recently effected the Marconi V. T. is the only vacuum tube. or audion, which may be sold to amateurs, laboratories, schools of instruction and experimenters.

> The approximate operating life of the MARCONI V. T. is 1,500 hours.

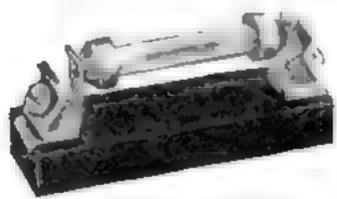
#### **Federal** Audio - Frequency Transformer

Designed for use with the Marconi V. T.

\$7,10



Standardized Socket \$1.50 additional



Standard Resistance, Complete \$1.00

The Marconi Resistance, connected in the circult between the grid and the filament of the Marcon V. T., is made to the following standard sizes

🍇 megohm, 1 megohm, 2 megohms, 4 megohms, 6 megohma.

Resistances of any special fractional values up to 6 megohins can be supplied.

Send all remittances with order to COMMERCIAL DEPARTMENT

#### MARCONI WIRELESS TELEGRAPH CO. OF AMERICA

Sole Distributore for De Forest Radio Telephone & Telegraph Co. Retail Sales and Exhibition Rooms, 25 Elm Street, New York. Room 1868 Woolworth Building, 233 Broadway, NEW YORK

BRANCH OFFICES:

Scholaid Bidg., Cleveland, Oblo-American Bldg., Baltimore, Md. Insurance Each. Bidg., San Francisco, Cal. 185 South 2nd St., Philadelphia, Pa-

134 Federal St., Boston, Mass. 361 Communical Bank Annag, New Orleans, La-



at home in spare time as you would be up a by the first of the major of the state of the first of the state o now hole ing good pressures.

#### EARN \$38.00 to \$100 A WEEK

Many of our maduates have reached high teaches rapidly on up to he recommend the same requirement on the start and out of the start and out of the start of the s

#### DRAWING OUTFIT FREE

We supply every student with a briving back tog one to specify the true to the There is no extendibute the this and it dished yardy personal property friend have

#### HELP YOU SECURE POSITION

We are beginn while in paste we shall enter the desired of the second of t

COLUMBIA SCHOOL OF DRAFTING Dopt, 1874, 14th & T Stn., Woohlngton, D. C.



#### HAVE YOU A WIRELESS STATION?

Wilpeleon equipment log to get tempore a single patrol or proposition is in a constitution of the single of the si

The one of declared and to do to so expect a fraction of a matter of the analysis of the sound o

The Besch of the ne tops included with he in a con-stile. If of gaps, in two opens a sould all any in of forestrate a soil may be not a tops, when they sould provide which have a result of the

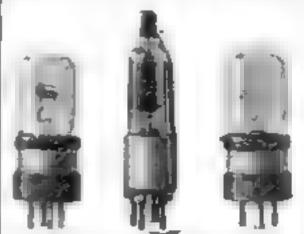
fillers Election on the set of the set of described to set upon the set of the set of set of the se

THE A. C. GILBERT COMPANY 110 Blatchley Avenue, New Haven, Conn.



The A. C. Gilbert-Mental Co., Limited, Toronce The A. C. Cichart Co., 73 High Helberts June fees W. C.

we must operate to get the loudest signals. In the case of the lowest curve shown in Fig. 3 the plate voltage is so adjusted that this part is at  $\epsilon$ , that is, it is on the axis of zero grid voltage.



Three German tubes picked up by American radio men in the war sones

Suppose now that the plate voltage is increased so that for zero grid voltage the plate current is given by od. Here the curvature of the characteristic is so small that the effect on the receiver by the incoming oscillations will be practically nil. But we can increase the

Short wave receiving makes it necesemplones. Its wave sary to use a grid length is \$6-110 meters battery which can

effect by increasing the negative grid voltage until the current is reduced to the value given by et. Here the effect on the receiver will be about the same as nt o. But this be inserted be-

tween the filament and the condenser C (Fig. 3). It is seldom necessary to use a grid battery when operating the

tube as a straight detector, such no shown in Fig. 3. But this consideration shows that if it is necessary to use a grid battery, the plate voltage must be correspondingly Airplane sending set



This, and the one If the plate you above, render treiltage is such that log serials temecoloury

the curve abe is obtained and if we operate the tube without a grid battery, that is, we operate on the point a, then the effect

. /2

Typical receiving circuit for vacuum tubes - without current pussthe blocking condenses ing through

when operating at c, because here the characteristic curves the other way The effect is that the plate the telephone

is opposite to

that obtained

receiver will be decreased whenever the incoming oscillations are impressed on the grid. This will also produce an

# \$5,000 Scholarships

To encourage echools to make practical applications of their class work and to popularize ecience, Popular Science Montaly will, at the end of this school year, award 10 scholarships of \$500 each to seniors in high schools and private schools.

#### Conditions

All that is necessary to win a \$500 scholarship. is to pass the best examination, based on the tornes in the Teacher's bervice Sheets of For LAR SE FACE MONTHLY for the month of Derenter 1010, and for the months of January it. June, 1986. The questions will be prepared by a committee of well-known educators who will determine the winners from the answers were in by the various candidates.

#### In Your Own School

The examinations will be held in he candidate's own er men. Withhere of the Schola while they believe any technical. n hand, them of all the Man and early Candidan es bound in he sure has their names are

#### February 1, 1920

the first to the case the sometime is volumed and aniety star marge for other it these echilla ship s-The name inches a stress of the book of the conditions on the series was to the Point of all of the missont. We see a state of restable books posteros, to

#### Scholarship Committee POPULAR SCIENCE MONTHLY

225 West 59th Street, New York

#### To Which Class Do YOU Belong?

There are two classes of men those who are keen for new ideas, curique about everything and those wh are

Class A Men-the sleet, eager minds who become the leaders of industry the men who become forences, superaptendents, factory owners—the Edisons, the Schwaba, the Hoovers.

These men have, from boyhood up, been been for new facts, always alert for information They are the readers of Popular Science Monthly —the response of practical information

Class B Men-the cosy going, don't care kind they ride with the tide

#### ADVANCE IN PRICE

One Year's Subscription, now \$2.00 After February 1, 1020 . . . 5.00

Special Offer You  $50^{\circ}/_{\circ}$ 

Popular Science Mouthly 22 West 19th Servet, New York

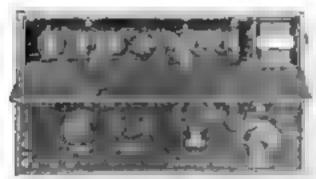
Make a mark in the square below and save \$1.00. The continues of S. Of they report \$5.00° De to page \$2.00° made in once in the square below.

Two years renews for \$4 10 new totics \$6.000. I will remit on receipt of the ... If you prefer you may remit with this order

Address

audible note in the receiver. It is therefore possible to operate either at the lower or the upper bend of the characteristic. It is, however, usually more desirable to operate at the lower bend, because this requires a lower plate battery.

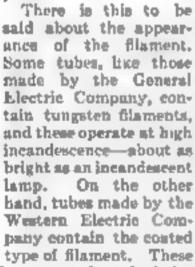
The filament current must, of course, be adjusted to its specified value. If the tube contains an appreciable amount of gas it will be found necessary to adjust the filament current



Compact set designed for use on the army tanks in warfare. Seven tubes are installed

constantly to obtain the best results, because such tubes are very inconstant. If the tube is well evacuated, however, the filament current can be adjusted once for all. Some tubes are designed to operate over a wide range of filament current and plate voltage. For example, the VT-1 type of tube designed and manufactured by the Western Electric Company for the U. S. Signal Corps, operates with a filament current ranging from 1 ampere to 1 25 and a plate voltage of about 17 to 22 bolts. With tubes of this kind, therefore, the operator can give all his attention to the tuning

circuit. This makes radio ecciving extremely sim-



A tube of low copacity for taking abort wave longths: kt la Krajlish

must never be operated at high incandescence. In fact, the temperature must never be raised to more than a yellowith red, because this only shortens the life of the tube and contributes nothing to increasing its sensitiveness. The coated type of filament emits electrons more easily than tungsten and will therefore give the same thermionic current at a lower temperature.

The audible component of the current in the telephone receiver when high frequency oscillations are impressed on the grid circuit, is called the detecting current. This current is usually very small. Some telephone receivers are capable of giving an audible tone when the alternating

# New Method Makes Music Amazingly Easy to Learn

Learn to Play or Sing. Every Step Made Simple as A. B. C.

TRY IT ON APPROVAL

Entire Cost Only a Few Cents a Lessonand Nothing Unless Satisfied



How often have you wished that you knew bow to play the violin or pagon-or whatever your iavorite instrument may be-or that you could take part in anging?

How many an evening a pleasure has been utberly sported and rained to be admission I can t stop. "

Hape.

CHEAR

i terlin

Ban IV

Mandolla

haraphone

dust Bet

1 lots

Lette

or No Lam were but I can t page

And now at met other pressure and metidaction that you have as stren washed for cast ensery be added to your daily life

No need to join a class. No need to pay a dollar or mure per lesson to a private teacher-

Neither the question of time nor expense is any longer a bar. -every one of the obstacles that have been confining your enjoyment to mere listening have now two protocount

My method of leaching mand by made in southware time at home with neutraliger caround to employee you make it

amendady easy to learn to sing by note or to play any instrument

You don't need to know the first thank about music to brgin-dust werd to know one suitfrom another. My method takes out all the hard part -- overcames all the deficulties -- makes your progress easy, might and sure

Whether for an advanced guipil or a beginner, my method is a revolutionary improvement over the old methods need by private teachers. The leseins I send you explain every point and show every at the sample Prins and Picture form that you can't go wrung on revery step to made as clear as A B (

My method is no thorough as it is may. I begin to be in a right way struch you to play. or sing by note. No track" muste, no "numbery, no makeshifts of any kind.

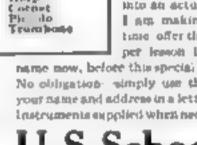
I rail my method new sumpry because it as an ruducally different from the old and hard-tounderstand ways of teaching music. But my method is thoroughly time tried and proven. Over \$25,000 moresulal publis-from boys and guis of 7 to 8 to men and women of 70-are the pr of. Largely through the recommendations of satisfied pupils, I have built up the largest school of munic in the world

To prove what I may, you can take any course un trial-singing or any instrument you preferand judge entirely by your own progress. If for any reason you are not extuded with the course or with what you learn from it, then it won I cost you a single penny. I guarantee estudaction On the other hand, if you are pleased with the course, the total cost amounts to only a few cents. a lesson, with your music and everything also

When learning to play or sing to so easy, why continue to confine your enjoyment of music to mere beteting? Why not at least let me send

> you my free bank teat tem you all about my methods. I know you will find this book absorbingly interesting, samply because it shows you how easy to in to turn your wish to play or aing into an actual fact. Just now I am making a special shorttime offer that cuts the goat per lesson in two-send your

name now, before this special offer is withdrawn. No obligation simply use the coupon of send your same and address in a letter or on a post card. Instruments or polici when needed, cash or credit,



U.S.School of Music 82 Brumwick

to rate. of Maste 62 Brable se send the bride frequency One Hear and par hubars of your Special (195) Maint Leasure on

David P

Name Address

A SURE SIGN Porchan Sentered M S to Y to Magazine of Practical Information is the barrometer that " a to be as A men who so does not be to the work. These readers of Port to will be Monthly are then who want to know what a n with Methanics and Science, Subscription price, \$2.00. After Pelicuary 1, 1920, \$3.00

For Segleners of

Advanced Pupter Harmony and Lampustion

dens nr

Heip

Laurele

fight binging

#### "ASA ASSESS BAN HAS & CD41 BrandesWireless Headset

TRIAL Put a Branche Par OFFER CONTRACT TO A P. O. the series are the art amaren are storing

"Buperior" Set 2900 mbress

Send to See Catalog 11,

C. SEAFDES, Inc., 32 Daine Sq., Room \$13, New York, \$1.5.4

#### WIRELESS CATALOG No. B-12

A new efficient wireless manual sentializing optimities private information enverse the metallation and mainunease of worker statems with thegrams abounty best methods of constructions. Macro and Contrastatal Codes: the latest and least in high grade radio transmitting spot reversing materialists. Send your name and address

Roady for distribution March 12

Manhattan Electrical Supply Co., Inc.

See S. etc. of Park Place Mr. man Tife Pipe St. Darriger, and the Works do Sen Francisco 404 Minutes St.

TEACH YOURSELF to half notest time, at triffing the with the wonderful to the live field Marrie or Craninottal movement at any openal, here as an even openal or which Adopted by to E. Gare to and feeding Universities, Cathogas and Talegraph Schools. A styles. Catholog tree. ORCHGRAPH MFG. CO., Dept. H., 39 Curtlandt St., New York,



#### "Gcc! Ain't She A Peach?



That's what your gaing'd may if you

#### other when Thed ster and the

Mylo-Much Coasier

Maybe your hadin will be there. rector which if Tellows obtained the content end the injure that the property is a second to less the property for less that the property for less that the property for less that the property for less than the second to the tell the content of th

#### More Prizes Coming

More Prints Coming

Now it you, or any of a crash plot and with you have any of a crash plot and with you have also her challent about the serial position of intents the serial that the seri

DUFFALO SLED COMPANY 157 Schanck Street, Horth Tongwands, N. Y. In Canada, Freston, Ont.

WANTED-A Representative to every fartory in the United States. Popular Science Hanthly, 225 West 39th Street, New York

## **PATENTS**

IF YOU HAVE AN INVENTION which you wish to patent you can write fully and freely to Munn & Co. for advice in regard to the best way of obtaining protection. Please send eletches or a model of your invention and a description of the device, explaining its operation.

All communications are strictly confidential. Our wast practice, extending over a period of seventy years, enables us in many cases to advise in regard to patentability without any expense to the clean. Our Hand Book on Patenta is sent free on request. This explains our methods, terms, etc., in regard to Patenta, Trade Marks, Foreign Patenta, etc.

If you are a mader of the

# SCIENTIFIC

you ere prehably name of the Impant perialne a description of a large number of recently pat-ented (symptions Pending petent legislation on well as the there second rulings of the Patent Office and the courts are countries in its columns.

683 Woolworth Building, New York 624 F Street, Washington, D. C. Tower Building, - Chicago, Ill. Tower Building,

current passing through it is only a few hillionths of an ampere. The detecting current can therefore be of this order of magnitude and still give audi-A way of measuring ble signals. the detecting current has been devised by the writer. Suppose we meas-

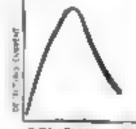
> ure it for different values of the plate battery voltage, the grid battery, let us say, being amitted. Then as the plate voltage increases the detecting current increases, reaches a maximum value and then decreases. again. This is shown by the curve in Fig. 4. The point e corresponds to the point e of Fig. 2. This happens when we use a circuit like that shown in Fig. 8. There is, however, another type

One of the power tubes that transmitted speech by radio, Washington (Arlington) to Roselulu and Paris. back in 1915

of circuit which has become well known and which gives good results. This is the circuit which contains the so-called "blocking" condenser in the grid circuit. form of this circuit is shown in Fig. 5. This circuit, which is also simple, differs from the previous one in that it contains the blocking condenser Cr and shunt resistance r. When the grid becomes positive it

attracta electrons and so becomes charged negatively. (See Fig. 6.) Since the grid is insulated this negative

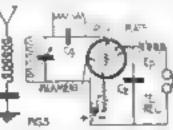
charge cannot leak off. During the next cycle of the incoming oucillations, when the grid becomes positive again, it attracts more electrons and becomes more negative. The negative charge on the grid decreases the plate current. If



MADE VOLTAGE

How detecting current Varies with plate voltage, using the circuit of Fig. 3

the grid is well insulated it will retain its negative charge even after the incoming oscillations have ceased. This



A receiving circuit having the "blocking" condenser in the grid circuit

we want because we the plate current to decrease every Lime the waves atrike the antenna and increase

is not what

again when they stop, so that we can get current pulses through the receiver. It is therefore necessary that the charge on the grid leak of between successive incoming waves. To accomplish this the grid condenser is shunted with a very high resistance



#### Your "Gas" and ALL Your Trouble

Evidence!—"I showed 32.8 miles on Maxwell demonstration with U & J Carburetor-321/2 m les per gallon with Ford,

M. E. Soott, Borry, Io.

#### U. & J. CARBURETOR

Doubles Mileage - Guaranteed to start car in Zero weather-No Priming. Entirely NEW principle-not a moving part: Simply. Has the Pep and Power. 60,000 delighted nears. Now ready for Pord, Dodge, Maxwell and Overland.

#### 15-BAY FREE TRIAL Money-back Guarantes

DEALERS—Service Stations, Salesment The "U. & J " sales on demonstration—installed in thirty minutes - some good epen territory

C. & J. PORD TIMER will test as load as the car. Price \$1.75.

u. & J. Carburetor co. Bept. 208-- 807 W. Jackson Mud., CHICARD



coil and steadies your acti-MAXIM SILENCER CO. M. Humpstood, Avenue, Hartford, Comp.



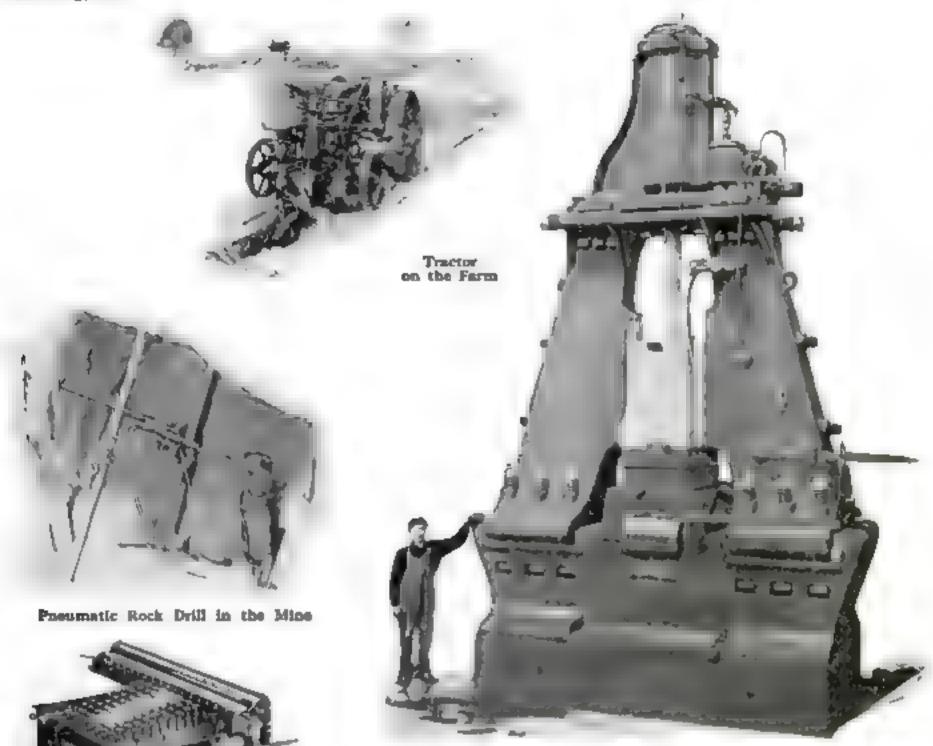


Your Lega will appear Straight if you wear Straightleg Garters quick rad used on say six

barness or padoed some S.L. Corner Co. 35 Yout Co. Bldg. Darton, O.



makry Co., 179 Westington har, \$4, Landy, 180-



The Drop Hammer In the Factory

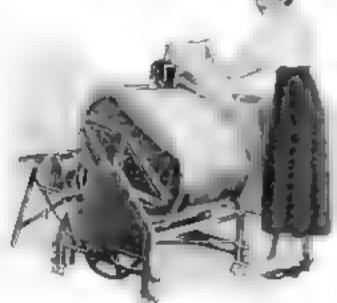
# Machinery and Inventive Genius

Adding Machine in the Office Production of the clothes you went, the find you eat. the modern cornforts of the bome, the labor aveng a is bethe office, the very money you use all involve the employment of wonderfully constructed and productive machinery

> The immense value of machinery to thousands of factories, factor, mores, offices homes to hundreds of different and under diversized industries surrywhere, cumost be computed.

New and useful machinery, of tremendous amportance to all lines of in fantry is continually being invented, patented, protected and put into profit-

The proper procedure in obtaining a patent for an invention is absolutely necessary in order that you may reader the profits that your ideas may be



Washing Machine in the Home

#### To the Man With an Idea

l offer a comprehensive, experienced, efficient service for his prompt legal protection and the development of his proposition.

Send sketch, or model and description, for advice as to cost, search through prior United States patents, etc. Prelaminary advice gladly furnished with-

My experience and familiarity with various arts frequently enable me to accurately advise clients as to probable patentability before they go to any

Bookiet of valuable information and form for properly disclosing your sites free on request. Write teday.

PATENT LAWYER OWEN, RICHARD 2776D Woolworth Building New York City

6 Owen Building, Washington, D. C.

# PATENTS

Terms Reasonable

Highest References

Best Results

Send model or drawing for profitminary contains that and report us to parametability

ALL BUSINESS GIVEN PROMPT AND PROPER ATTENTION

WATSON E. COLEMAN, Patent Lawyer, 624 F \$1., Washington, D.C.







Tool can leave For True, One-Star, True-Step Walts and latest "up-be-the-solvests" me sety threat in past new Asset by the wanterful Fresh Aparem of Mail Impropriate.

New Montrean Method Reside bearing bearings:
made seeled the main height every fill.

Write for Aparella Terrons. Send to day be filled to the fill of the filled bearing bearing bearing to the filled the filled bearing bearing bearing.



# 500 % PROFIT

Gold and Silver Sign Letters one from the other originate and a take scene It has the experience arrowing Labor warmer than the seal make mesey might a start arrow.

\$30.00 to \$100.00 a Week!

my eigh each to mounts; trade of trained all details or at 2. I have so a long decision? On other to be recording to the enter account. Small for France integration and (all participation) Liberal Offer to General Accuse.

METALLIC LETTER CO., 4314 N. Chick St. Chicago

The Police Key

### o se serviceable se a whole bunch of ordinary

keyngapun almattavayılıng, ovey kenagreater about these parts. Sent putpaid on marine of 20 cents, three for 50 costs. Salesy Key Haider from with away key-Sharpe Mfg. Co., Paterson, N. J.



r, which should be in the order of one or two million ohms. It is so high that the charge on the grid cannot leak off nearly as fast as it is built up by the incoming oscillations which, of course, pass through the condenser, But it can leak off before the next train of waves strikes the antenna. The plate current therefore varies as shown

branchation parameters

Andrews of the same of the same of

Grid Cummnt

Grid potential

Current in talephone

How incoming usell-

latsons are changed

by the vacuum tube

to currents the re-

by the last curve of Fig. 6, that is, the oscillations become audible.

With this method of detecting it is demrable to have the grid current increase agrapidly as possible. Furthermore, it is desirable to Reaulting Plate Current operate on such a part of the plate current characteristic rus that a given change in the grid potential produces the largest possible egivers cap recognise change in the

plate current. Both of these conditions can be secured by properly adjusting the plate and grid battery voltages. Fig. 7 shows the plate and gnd currents for varying grid voltages. The curve at is the same kind as that shown in Fig. 2. The curve or shows the grid current for positive grid potentials. When the grid is negative with respect to the firement, electrons are repelled from the grid and the grid ourrent is zero. But when the positive grid potential increases the grid current increases slowly at first and then more rapidly as indicated at e, that is,

when the grid potential is equal to od. Now when the grid has this potential the plate current is given by the magnitude do. and here the plate current curve la quite steep, so that a small change in grid potential produces quite a large change in plate current. In using

- O+a GRED PUREWINE.

When grid potentials change, plate and grid corrents vary as indicated above

the tube in practice in the circuit shown in Fig. 5, it is necessary to know the value of the grid potential at which the grid current is steepest. also necessary to adjust the plate potential so that any variation from this grid potential produces the greatest possible change in plate current. This would need some adjustment. But we can obtain pretty nearly the best grid potential by simply connecting the grid circuit to the positive end of the filament, as shown in Fig. 5. When this is done the rest of the filament is negative with respect to the grid, the other end of the filament being negative with respect to the grid by an amount equal to the potential drop in the filament due to the heating current. With this connection it is then simply possible to adjust the plate potential until the signals heard in the telephone receiver are loudest. Usually it will be found within certain limits that the response in the receiver increases with increase in plate potential. This increase is at first rapid and then goes more slowly,

MODEL TO THE PORT OF THE PORT

NUMBER CHARGES BY

How the plate current is increased by contin-

HOUS INCOMING WAYES

so that there would not be much gain in making the plate potential too high. In the VT-1 type of tube, for example, the detecting action is about as good at a plate battery voltage of 25 volts as at 40.

This is different from what takes place when using the tube without a grid condenser, where the detecting current, he was shown in connection with Fig. 4, again decreases when the plate potential becomes too high.

When the tube is used with a grid condenser the incoming eignals are generally heard more strongly than when the grid condenser is not used. A capacity suitable for this purpose can easily be obtained. It should be about 150 to 500 micromscroferada. with a leak resistance of about two milhon ohms bridged across the condenser. With a well evacuated tube there is really very little adjustment necessary. First set the filament current to the specified value. This should not be adjusted according to the brightness of the filament, but rather to the current that is specified, because tungaten filaments operate at bright incandescence while the coated type of filament operates at red heat. After the filament current is set the plate battery voltage can be adjusted until the signals are strongest. It may be possible that this may be further improved by adjusting the capacity of the grid condenser. Once these quantitles are adjusted the tube circuit needs hardly any attention. All that is necessary then is to tune the input circult to the frequency of the incoming waven.

An idea of the sensitiveness of the thermionic detector can be obtained from the following figures. In a good telephone receiver the least amount of power that it is necessary to expend in the receiver in order to get a signal that just barely enables one to discriminate between dots and dashes under normal conditions is a few micromicrowatts, that is, a few thousand-billionths of a watt. The power that a good thermionic detector will give in the form of sudible current in the receiver when the strength of the incoming waves represents an input of

# DATENTS TRADE-MARKS

Before disclosing an invention, the inventor should write for our blank form "EVIDENCE OF CONCEPTION". This should be signed and witnessed and if returned to us together with model or sketch and description of the invention, we will give our opinion as to its patentable nature.

Our Illustrated Guide Book, HOW TO OBTAIN A PATENT, sent Free on request. Contains full instructions regarding Patents, Trade-Marks, Foreign Patents, Our Methods, Terms, and 100 Mechanical Movements illustrated and described, Articles on Patents Practice and Procedure, and Law Points for Inventors.

Highest References

Prompt Service

Reasonable Terme

PREE COUPON! -

#### VICTOR J. EVANS & CO., Patent Attorneys

New York Offices 1001 Westworth Bidg.

Philodolphia Office 135 S. Brand Street

Pittoburgh Offices 614 Empire Bidg. Chirago Offices 1114 Tanoma Bidg.

Main Officer: 760 9th Street, N. W., WASHINGTON, D. C. Gertratern Please and see PREE OF CHARGE your Book as described above.

MARK

Acces one

#### DEAFNESS IS MISERY



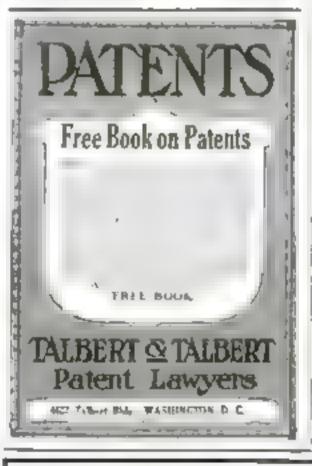
These present from Deal and And Mind Notion to not 20 years. We arreste An explicit Last Decimal method for the property and respond that Notices, and all the action that mean. They are lawyed to start to the same of the property and respond to the property of the property and the property of the prop

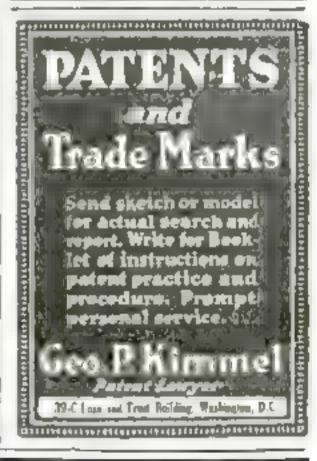
der Stra, do Schr denning . . How York City

## PATENTS PROCURED and TRADE-MARKS REGISTERED

Eighteen Years Enperioppe, Instructures and Terms on enginest

ROBB & ROBB, Attorney at Law specializing is Potent and Producent Produce excludedly 1990 \$4 January 1960. 1230 is included life of American Color. It is extend to blue.





# PATENTS

IF YOU HAVE AN INVENTION and DESIRE TO LEARN HOW TO

SECURE A PATENT, send for Our Guide Book, HOW TO GET A PATENT, sent Free on request. Tells our Kerms, Methods, etc. Send model or sketch and description of your invention and we will give our opinion as to its patentable nature.

RANDOLPH & CO. 130 F St., N. W., Washington, D. C. STATE



It's wonderfully quick, sunple, easy and economical to make your own flashinght batteries with a

### Make-Ur-Own Flashlight Battery Outfit

Just a matter of a few moments easy assembling and presto! You have a light that is brighter, stronger and better than any you have ever used and it will last longer, for the battery has not become weakened from remaining on a dealer's shelf, and deterioration does not begin till you actually use the light. With Make-Ur-Own Batteries you don't assemble them till you actually need the light

We will send you a flashlight and enough

material for six batteries upon receipt of \$2.50. If not entiafied at the end of five cave, return the outfit to us not we will refund your money

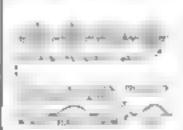


WEILER MFG, COMPANY Dept 610 DUNKIRK, N. Y.

#### TRAFFIC INSPECTORS



one volt on the grid, is about eight microwatts. This power is therefore still several million times as large as is necessary to give a readable signal. However, an input of one volt represents a very strong signal, and the power in the receiver drops off very rapidly as the incoming signal strength decreases. The smallest input voltage that still gives a readable signal is seldom less than a few hundredths of a volt—that is, when the grid condenser is not used. With the grid condenser the sensitiveness is greater.



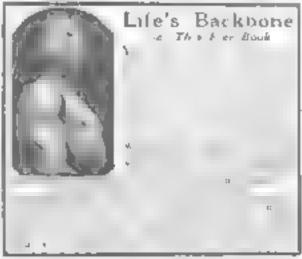
The effect of modulated waves on a tube a plate current Now, there is a simple way in which the signal as heard in the telephone receiver can be strengthened. The two circuits shown in Figs. 3 and 5 can be used in radiotelephony. And

if the voice coming on the waves is not strong enough it has to be amplified by connecting an amplifler tube to the output of the detector. This can, of course, also be done in radiotelegraphy, but in this case the above circuits can be used only when the incoming waves come from a spark transmitter or condat of oscillations that are interrupted at a frequency lying within the audible range. From the above explanation it will be clear that the waves striking the antenna cause a change in the plate current. If these waves are continuous there is produced simply an increase in plate current if the tube is used without a grid condenser and a decrease when used with a grid condenser. This change in the plate current will remain constant as long as the incoming waves remain constant (see Fig. 8), and such a change in the direct plate current will produce no audible note in the receiver connected in the plate circuit. But if the incoming oscillations are laterrupted with a frequency lying within the audible range, the plate alternately increases and decreases with this frequency and a note is heard in the receiver, which lasts as long as the intersupted oscillations strike the antenna.

In the case of radiotelephony the oscillations are not interrupted but their intensity is increased and decreased according to the voice currents produced in the transmitter at the sending station. The waves are said to be modulated by the voice currents. In Fig. 9 is shown a radio-frequency wave that is modulated with an audio-frequency sine wave. The original sine wave is again obtained in the receiver placed in the plate circuit of the detector

When the incoming oscillations are continuous, not interrupted or modulated at an audio-frequency, they can also be made audible by making use of the phenomenon of beats. It is well known that if two tuning-forks are struck, that produce notes differ-







The Orland Lag Cast does be work of less man. Makes therefore he can be 'pe triville. When not passing word on for pumping fact primiting etc. Remite semiconical direction. The quantitative of President in the Pully guarantees. In days the statement of the President of the purpose of the pumping of the pu

# Deafness



Perfect hearing is now being restored in every condition of dealpose or delective hearing from causes ouch as Carar hal Deafpress, Reissend or Sunkes Drums, The kented browns, Rom one and Hearing Sounds, Perforaled, When your Partially Destroyers Drums, Duchargo from East, 400,

Wilson Common-Sense Ear Drums
"Lattle Warriers Phones for the Ears" require no medicine but effect vely replace what is locking at the clave in the natural car drums. They are simple devices, which the weater easily fits into the establishment bey are invitable. Solve as a result contortable. We de today for our 180 page FREE book on DIAF.

\*\*ESS.\*\* givene you full particulars and testimonials.

SOLDERALL CO. Days 7

# WHO READS Fopular Science Monthly

The Magazine of Practical Information?

The heen-syed bostoom or professional man and the skilled workshap—all ambraous men—who from boydoned up have been on the alert for new factor always reserve for information.

Subscription the Year 57 09. After Seb. 1. 1930, \$1.00.



17 Cents a Day Pays

The property of the Secretary Plane Secretary of the Medical Secretary of the Secretary

tot gride per mit. Total in word is due. Freed revers dipole with the state of the

#### Symphonic Pianos Also Player Planes and Granda

Instruments by a total indice. Propagations whereas interested to the first of the first on the Paris Plant of the first of the paris Paris of the first of the f

Zarkitr Go. Duk PFSM-131, Bellin, N. Y.

#### WE THINKS AT GRADUATES POSITIONS

worth \$2.25 per month. Turning out men every week. Wrate for catalogue (fourth edition with full particulant of our 20 weeks' correspondence COURSE

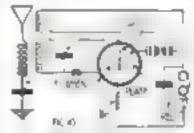
SERVICE RADIO SCHOOL Supt. M. 900-2 Pa. Are. Washington, B.C. "THE LINCOLT RANGE SCHOOL IN THE





ing elightly in pitch or frequency, a note is heard that waxes and wanes at a frequency which is equal to the difference between the frequencies of the notes produced by the two forks separately. Now, suppose oscillations impressed on the input of the detector have a frequency of 300,000 cycles per second, and are continuous so that they produce no audible note in the receiver. In order to make the osciliations audible we can impress on the input of the tube another train of oscillations from a local generator If the frequency of these osciliations is, say, 301,000 cycles per second, then a note will be heard in the receiver in

the plate circuit, the frequency of which is the difference between the two frequencies impressed on the grid, namely one thousand

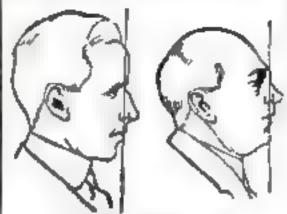


This "feed back" circuit wonderfully improves an experimenter's receiving set

cycles. This method of detection is known as the heterodyne method. It not only has the advantage of making the continuous carllations audible, but it also increases the intensity of the note heard in the receiver. If the strength of the incoming oscillations corresponds to an input of e volts. on the grid and that of the locally generated oscillations e<sub>3</sub> volts, then the detecting current, that is the audible current in the plate circuit, is proportional to the product or Hence by making the local oscillations strong the detecting current can be much increased, even though the incoming pacillations may be very weak.

As a source of local oscillations a thermionic tube can be used, because it can easily be made to act as an oscillation generator. In fact it can do quite a few other things beardes. This method then requires an addition in the form of a generator to the simple receiving circuit. But this is not necessary any longer, because a later development of the art has shown that it is possible to make the tube act as detector and an oscillation generator at the same time. The circuit with which this can be done in very simple and is shown in Fig. 10. It is known as the feed-back circuit, because by means of the coil L, part of the energy in the plate circuit is fed back to the input circuit LC. The tube acts as an amplifler, that is, for an amount of energy in the input circult we obtain a larger amount in the plate circuit. If now part of this energy is returned to the input it will be further amplified, and so escillations will build up until checked by the limitation of current that can flow through the tube. The frequency of the oscillations so formed depends on the frequency constants of the tube and its circuit. 'The feed-back coil L<sub>1</sub> can be of about the same value as L or even smaller, and should be so

### Don't Guess!



LEARN HOW TO KNOW MEN!

> to sell them -to employ them -to direct them

HAVE you ever not an order in setting?
This is the wing many for he are not successfully? The course you have "Why? The charges are "you did not know your man."
Minables in making it is button wante are

Minabre is links in the notices in the same and farest all large time a success in the high-same and making words.

to be that it early it a more direct atempte as of a company in the S. One in M. The set Space of Fr. part to go here house

"The Science of Approach"

Mr. Taplor shows you the best way to quickly approximate or common of the property of a second of the second of th

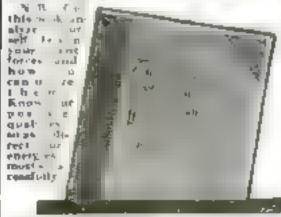
#### The Key to Men's Minds

I w or H 10 112 kin william 11 11 of the state of th give a septi-

#### On 5 Days' Approval

The life of the second your fails buck.

Ther opportunity is presented in the companbetween the All I standard in the compantender when and the Table Standard is the
two will be effective as great. It has
tended to the Standard of the first
to the standard in the first the standard of the standard of the
two the standard in the first the standard of the



WILSON M TAYLOR Sales Efficiency Expect, New York City

Please send me copy of your book. "The Science of Approach" on 8 days approach concased find \$2.00. If I decide not to keep the book, I will return come in you within 5 days and you are to return the \$2.00 without come for \$2.00 without question

Name

5 defress

P R 30 Feb 29

#### Last Big Block OF THE CANADIAN PACIFIC RESERVED FARM LANDS

THIS announces the offaring of the last big block of the Canadian Pacific Reserved Farm Landa. Until this black is disposed of you can secure at low cost a farm home in Westera Canada that will make you rich and todependent. Never again. on the American Continent will farm lands be offered at prices BU OW.

Last Big Opportunity

The block contains both fartile, open prairie and rich part lands in Lieyd-control and Hattieford Detrots of Control Alberta and Sashutchevan, Farm Lands on the rich prairies of Manitoha, Sashutchewan and Alberta are \$11 to \$30 ap acre. Lands in Southern Alberta under an irregation and street of anguillag water from \$50 and area up. BE BEFO UP.

Iwenty Years to Pay

The Canadian Pacific offers you this land under a plan of long term, dary payments that is remarkable to the history of farm investments. You pay draws 10%. These you have an payment on the principal until the end of the fuerth year. Then fifteen around payments. Interest is 6%. In Conval Saskatchewan, Sunger Wheeler grow the world's price wheat World's price sate wwo grown at Lleydminster.

#### Lands Under Irrigation

In bouttiers, Alberts, the Campling Paper, let with been a relayer to a signal and the letter of the second of the bound of the letter labels of the labels of the

#### Special Rates for Homeseekers and Fulf Information

The Landing Parish with interference of farm and I have been imposed in the make this same approach submay taken have been in expect. It make they are been in expect. It make the my arms the best of the farm of the farms there is the farm of the farms the months of the farms of the months of the farms of the months of the

M. E. THORNTON Augs. of Coloniasing

Canadian Pacific Railway 965 First St., E., Calgary, Alberto For Al Information about Canada,





Big Band Catalog Sent Free Whatever sen need to the habest or ad more than each of the ten and had che more than each of the ten and have the more than the ten and the ten than the ten are PAR THERE LYON & Heavy



ranged that the coupling between the two coils can easily be varied. This can be done conveniently by rotating the feed-back coil. When using this current it is necessary to insert the grid battery E, so as to maintain the grid at a negative potential with respect to the filament. If this is not done the grid takes too much current and this reduces the sensitiveness of the device.

This circuit is very simple to operate. Once the plate voltage and filament current have been adjusted the tube can be left to itself. It is then merely necessary to tune in by means of the condenser C and adjust the coupling of the feed back coil. If the circuit does not work, it will usually be found that either the plate voltage is too low or the filament current too low If the plate voltage is high enough a small increase in the filament current will usually set the tube operating.

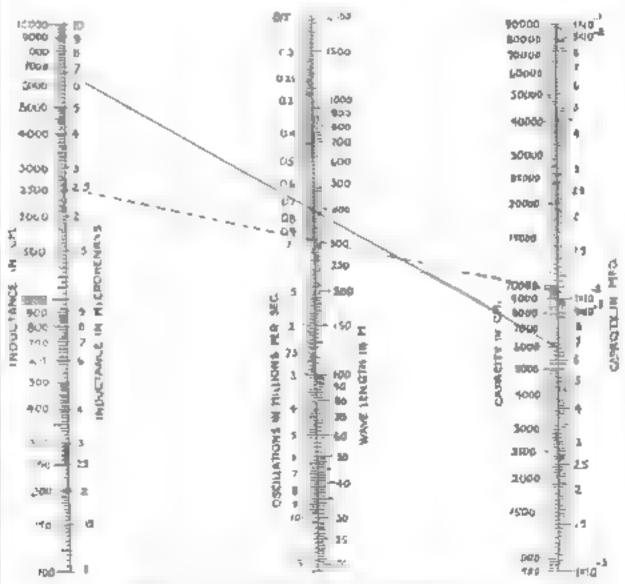
As in the case of heterodyne receiving, so with this simple circuit the sensitiveness of the tube can be greatly increased. With such a circuit it is possible to pick up telegraph messages coming from very considerable dis-

#### Find Wave-Lengths by Chart

N any circuit containing capacity and inductance (that is, a condenser and a coil of ware of some form . it is usually very difficult to find the wave-length and natural (requency involved the formulas for this being numerous.

Here, however, is a chart by which

as a straight-edge to reach across between the figures in the three columns. If you haven't a book or paper, use a thread, or a piece of string. At any rate, the idea is merely to get a line across the columns connecting the values of capacity and inductance which the operator circody



Given any two quantities about an serial circuit, the other may be obtained from this table at a glattee

around the laboratory, or whether it have within it an aerial and other radio apparatus, the chart will work as well. Few diagrams that the POPULAR SCIENCE MONTHLY could publish would be possessed of so much all-pround usefulness to the radio student

To use the diagram, merely lay a book-cover across it, or a sheet of paper, and use the book or paper s edge

the values may be obtained almost at a knows. Then, where the line interglance. No matter whether the cir- sects the center column, the wavecuit involved be just an ordinary one length and frequency which the operator deseres will be shown. Obviously, if the operator happens to possess the wave-length and the capacity of the circuit, instead of what he had before, and lays his straightedge connecting these values on the center and right-hand columns, then the value of inductance necessary will be made plain where the straight edge intersects the left-hand column.

So knowing any two values about

an oscillatory circuit, the third may be obtained from this simple diagram.

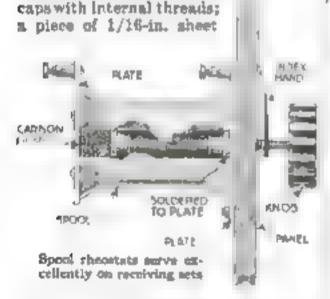
For example: Suppose that one knows in a given circuit the selfinductance is 6,800 cm., or 6 8 microbearys. He therefore places one end of his straight-edge at this value in the left-hand column (see black line in the drawing. He also knows the capacity is 6,000 cm. The other end of the straight-edge or black line is thereupon placed at this 5,000 cm. value in the right-hand column. This maxes the black line intersect the middle column at about 400 meters, the wave-length desired. So on with any other values of inductance and capacity

This particular chart was worked out by a German officer, P. Luckey by name, early in 1917, and was captured by American forces. The idea is not particularly new, as there is one in the American book by Mauburgne entitled "Wavemeter in Wiroless Telegraphy," and also in the book by Eccles on

radio,

#### Control Your Filament with a Spool Rheostat

THE essentials for this rheostat are: One empty spool about 134 in. long; a 34-in. bram rod about 234 in. long, threaded with 8 32 thread; two dry-battery binding-post



bram, some binding-posts, a knob, a pointer, and a scale.

The end-pieces for the spool are cut from the sheet brass. The back piece is fastened to one end of the spool with screws. A dry-battery binding-post cap is so dered over the middle hole in the front piece. A similar cap is soldered to one end of the brass rod. The rod is then screwed through the cap on the front piece, ready for use.

Enough pulverized curbon is put in the open end of the spool to fill it about one quarter full. The piston is then inserted and the front piece securely screwed to the spool. Three holes are dailed in the panel and the rheastat bolted to it. The knob pointer and scale may then be attached. Electrical connections are made to the front and back pieces. Screwing the knob in compresses the carbon, reducing the resistance; while screwing it out produces the opposite result.—Harold J. Hasskourk, Jr.







# What 15c King You the Nation's Capital

Washington, the lease of the Parishager, this becomes the World's Capital and runding the Polishader will be then uniting in the terms occur if with these who will maid the united to describe the united to the united

The legic saming of the is properly to be to be bridge you be "light bodge to weather on treat. The Published a property of the service of the property of the



**ATRONOFORT** The Parton Man. A THAN THE PROPERTY OF THE PRO g a k ne h it am Fore if Heart in liage with pr! \* ::

#### MAKE A MAN OUT OF YOURSELF

| Part of the Act of t Mir In by a find a band by

Description groups of a superior production of the superior of

#### BUILD UP YOUR BODY

The same described of the same of the same

that is a major broad the attention to specify the second of the property of the second of the secon

#### STRONGFORTISM

The grandes of declar of the set state for the fit of the control of o

#### BEND FOR MY FREE BOOK

Perment of and Conservation of Dealer Perment of and Conservation of Dealer Perment of the series of

#### LIONEL STRONGFORT

Physical and Health Specialist 1152 Strongfort Institute, NEWARK, N. J. .... CUT OUT AND MAIL THIS COUPON.....

My primed to defect the property of the proper

Tallet. Cararela Architta Unseite Headache Thinn-se A place Landbergen Wasprich Searn gin (Sefu unity (Interfet)

VAME

Addition.

Insample. Stor Wind Flat Feet Stormach Discoplere Constignation Ill intendess Topped I beer Indiges bit Secondopess From Memory

g geralista Hamiltonik Bere Head I well been frage in markets Sain Dissaiden Fen Mind rec Engral Standort Lung Transfer Interched Heidet Samp Transfer Standort Harting Transfers

Dud Kapite

No. of State State

STREET. pt & P.

#### Supposing Back-Yard Aerials Were Really Large

THE great wireless masts, which sometimes rise to a height of 300 feet and more, present many mechanicallantheulties. Although constructed



The ball and-socket joint provides needed flexibility, allowing swaying

of open steel latticework, they are swayed back and forth by the wind, frequently swinging as much as eighteen inches from the perpendicular.



Concrete makes the anchorages firm

The bases of the masta are therefore built upon the principle of the ball and socket. The base narrows to a point, or rather a ball, which is net in a steel nocket firmly embedded

in concrete. The mast is then braced by a series of steel ropes attached at various heights, which run to concrete

unchorages purrounding the base. The tall structure may therefore awing far from the perpendicular without endangering it. The concrete base makes it possible to taise the entire structure on jacks necessary.



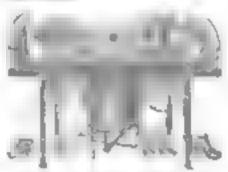
when repairs are Winds and tail acrisis are no friends

Owing to the fact that many farmers are changing to gasoline engines to run their pumps, it should be possible for numerous amateurs to secure old steel windmill towers as supports for their aeraals. Often these towers are 70 or 80 feet high. Then if 20 or 30 feet of pape were mounted in their tops, serials of considerable beight should result.

#### Open a Tire Repairing Shop!! Business Good and Fast Growing

VANDERPOOF VUI CANIZER ,5 Charty has callactly of SI to worth of work a day. We are the process in the manufacture of the Dry Cure Lindbaddage 5

With the VANDERPOOL VULCAN-IZER no experience is necessary. We give you free instructions. Write toy for FREE TIRE REPAIRING MANI AL and full particulars, If others can be successful, so can you be. S Fine Local



In answering address Direct P 80.

WM. TANDERPOOL CO., Springfield, O.







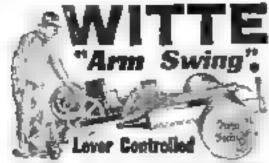
#### SEXUAL KNOWLEDGE

ILLUSTRATED SEX PACTS MADE PLAIN ben ege graph young man and Erers soung woman should know What every young heatened and Every houng wife about Anom What every parent should know that parent 120 pages many illustrations.

1

Postpeid Balto in puss Balter AMERICAN PLS. CO - 217 Witness Bldg. Philadelphia

K-p. Take on all new town lens and discovering by harmonic to POPLIAR SCIENCE MONTHLY



### DRAG SAW

A Practical, Safe, Easy-To-Use, Low-Priced, One-Man Outit for

Farmeri, Timber Men, Contractors, Blingle Mills, Starr Makert, Ber Makers, Lagrert, Wood Cutturn, See Packers,

and ahandy mency-making sould for tho map who has timber hand to clear. Easy to sperate on any size or kind of log. Shipped anywhere, complete, with new, costly for work.

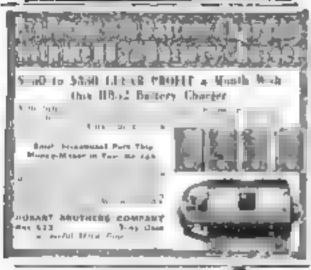
#### Direct From Factory

You have direct from WITTE—you get quick abspricht. You get a remolete power plant for log saving or less saving. Engine to decycle WITTE, water cooled. Eligh-spect gent-drive. Are flwing Lover operation to little por pathola. No chalence being Priction clutch, operated by hand lever, instantly starts and stops as we wind taging is runping. Starts saw at some speed or full spend. Clutch works as stronger that the flavorable whose, Can be heated or pushed anywhere. Hig should pay for treatf in 10 days. Hig 2 color fallow bridge all about the "Arm Swilling" and other as cluster WITTE improvements, Before you decide on any caw out of terragion. — WRITE TO WITTE. "Get WITTE prices and save possess."

#### WITTE ENGINE WORKS

TARLE STY, MR.

Prittspunga, Pa. 2224 Empire Bidg.



#### **ASBESTOS**

We are miners and shippers of Crude Ashestos in any quantity. We produce all grades at our world famous BELL ASBESTOS MINES, as Canada. We also card fibres, spin years weave cloths, and make all sorts of Ashestos products.

For anything you want in Asbestos, turn to KEASHEV & MATTISON COMPANY Days 8-4, AMBLER, PENNA, U.S. A.

Owners of the world's largest Asbestos Mines.

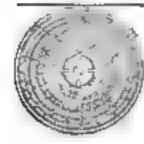


TOOL CASES EXCEL

nr binight aget Tree Ata are of he ment excluded actors of the ment excluded actors which is no price; - Indon-she shippingst through the property of products.

The Pilliod Lumber Co. Put A. Swanton, Obje

The Midget Slide Rule

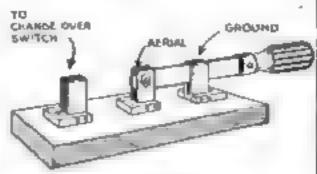


will best so by add, unbitrart, to exhipty about a group or a first property of the source of the so

Gillion Sitch Rule Co-Nilles, Mich.

#### Close the Ground Switch and Avoid Lightning

In every radio installation there should be a ground switch installed at the point where the aerial enters the building. This may consist simply of a heavy single-pole, double-throw knife switch, the knife of which is connected to the serial. The contacts, one at each end of the switch-block, are respectively connected one to

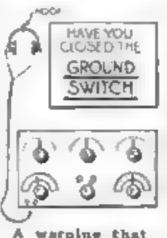


A ground switch should always be instanted where acruals outer bundings

ground and the other to a changeover switch. This latter switch then permits either sending or receiving apparatus to be cut in on the serial, according to the desires of the moment,

But the idea in the ground switch is that when the operator is not using his apparatus he may swing the knife of the switch over so that it comes in contact with the side that is grounded—in this way, in effect, running the aerial into the room and directly out again into the earth. This is a good idea, for the reason that the serial is like Franklin's kite—it picks up lightning. Unless this ground switch is "closed"—that is, engaging the contact that is grounded—the light-

ning is liable to enter the room and damage the radio apparatus. So radio amateum should always close the ground switch when leaving the apparatus, for a thunder shower may come up in their absence. and cause no end of damage. If the ground switch is locked with a



A warning that helps to keep the ground switch closed

padlock of some kind, it also prevents unauthorized persons from using the set, unless they disengage the wiring entirely from its accustomed positions.

A radio student, Philip A. Wall, suggests that experimenters prepare a large sign, reading, as shown in the illustration: "Have you closed the ground switch?" If such a sign were mounted on the wall near the hook where the net-owner is accustomed to hang his receivers when through listening, it would serve as an effective reminder to close the switch. Older amateurs know these things already. The younger ones, however, need the admonition.



### Learn Drafting

Employers everywhere are looking for skilled draftsmen. They are offering good mianes to start with splendid chance for advancement.

Drafung offers exceptional opportufaities to a young man because drafting itself not only commande good pay, but et is the first step toward success in Mechanical or Structural Engineering or Architecture. And drafting is just the kind of work a boy likes to do. There is an easy designiful way in which you can learn right at home in space time. For 28 years the International Correspondence Schools have been giving boys just the training they need for success to Drafting and more than 200 other subjects. Thousands of boys have stepped into good positions through L. C. S. help, but never were Opportubilies so great as now,

Let the L. C. S. help year. Choose the work you like best in the coupon, then muck and much it. This doesn't obligate you in the least and will bring you information that may start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon now.

INTERNATIONAL CORRESPONDENCE SCHOOLS

WOX 7664, 5	CRANTON, PA.
Capitala, without obligating t	he, here a can qualify for the
restime, or in the suffect, be, from bifab, passages,	Dealeswande
	ADVER PSING
Electric Witning	Window Thanks
Riografie Habiling man Syn. Liverine Waring Telephone Worth Bill (41) AL Businishing Bellanden Byolyphu Berlanden Byolyphu	Dishow Card Writer
BEI HARDEL BARRER	Andrord Testamen
Berkunten Breitert	TH LUATRATING
Lookenker	Section in the sectio
Gas Lagrae Operados	Private Statement
TOTALL ENGLISHED I	TROOMER'S LEW
mink Aufthall wit bir bir ber	ert l'ub Accountant
"Brattonakt zumennne	TRAFFIG MANAGER
Principal Tableson	Bellway Accountant
ANCHITETT	GOOD EXCLEN

Shoring Tapthers

Ship Dra frames

All CHITEET

Intrades pad Fallier

Fraktisetera Drafting

Court for the fall of the fall of

7.5	 
Orrupation.	
Statement .	 
cond 76s.	

handles rung and the respect to 7 84 of Administrational Companions of Makesle, Spectrus, Outside

# Improving the Machine Hours

HOW may you know that you're getting a real day's work out of a machine, unless you know that each hour is improved to the utmost in point of product and profit.

Veeder Counters will add up each hour's production, indicate the full amount to be had giving an output-equivalent for time. And with this standard in mind,

# COUNTERS

enable the machine-operator to work with a fixed goal and a steady purpose, averaging up to the proper rate-of-work by watching his record on the counter

This small Rotary Ratchet Counter (No. 6, counts reciprocal of move



menus at the lever as restaining the output of purish present. When the lever is moved through an angle of 40 to 60 degrees the counter regulars one. A complete revolution of the lever regular

tern ten. This country is adapted to no error of counting purposes, tamply by deputating the throw of the fever Price \$4 (Cut nearly, all size)

The Revolution Set-Back Counter below is designed for targer that chines, where a shalf-revolution indicates an operation,



Reguters one for each revolution of shaft, and acts back to zero frame any figure by turning knob once round. Supplies with from four to ten figure wheels, as required. Price with four figure-wheels, \$9.00 matricts in discount. Call trea there—size—sell-Back Rotary Ratchet Counter of samilar size and type, \$10.50 test.

Other Veeder Counters are supplied excording to your requirements in great earliety of size and style. Let us send you the bucklet that shows them.

The Veeder Mfg. Co. 44 Surgeant St., Hartford, Conn.

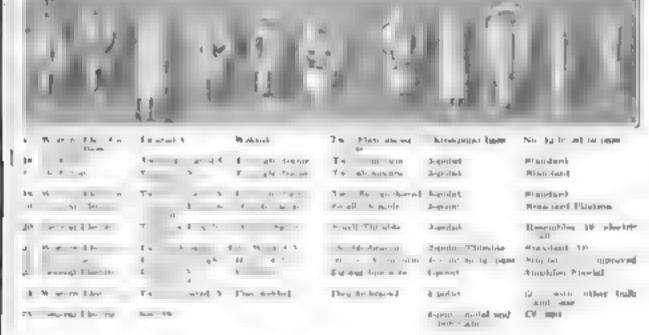
#### Navy Vacuum Tube Collection

THESE consum tube pictures we are able to present through the courtesy of Commander Hooper of the Nary. The collection was tested by Lieutesiant W. A Eaton, and Radio Aide Horle during the war. The radio student will find a study of the different types of great interest.—Editor.

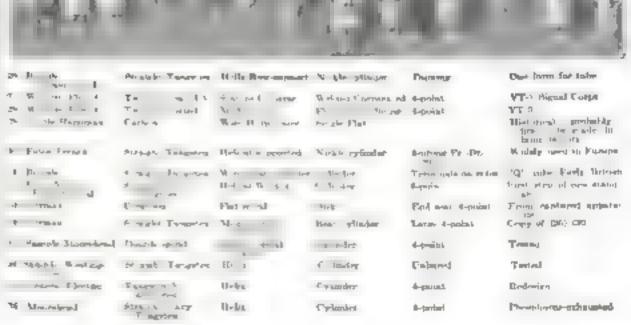
Early Types



Improved Types

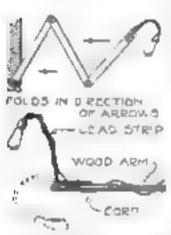


Foreign and Uncommon American Tubes



#### A Handy Electric Light for the Work-Bench

EVERY work-bench needs a good aght, one which is adjustable and capable of being moved about from



Make your own bracket have for the work bench It will repay you by g v inguight where it is needed

one end of the bench to the other. Swinging lights are usually in the way, and those upon tracks are liable to get out of adjustment.

Two folding brackets like those illustrated are used to advantage about the ebench, for they fold back out of the way and

permit the light to be raised or lowered at wil.

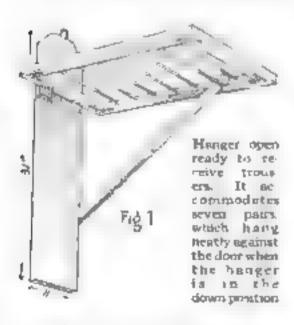
Cut out three sections of hard wood and fasten the ends together with bolts and washers. Make a joint just tight enough so the pieces will swing apart without binding too tight Bolt one end to a block at the rear of the bench so that will swing also.

Mount a strip of lead vertically on the front end about 15 in, long and attach the lamp to it. Use a flexible cord between it and the wall. The lead can be bent and straightened at will and thus lowers or raises the light By folding the bracket in or out the light can be set near the front or back of the bench or swung to either side. - L. B. ROBBINS.

#### Keep Your Trousers from Wrinkling In the Closet

THE most difficult garments to dispose of conveniently in the closet are the trousers.

The illustrations accompanying the article illustrate an ample home-made trouser hanger which will keep all the extra pairs of trousers in one place



and at the same time will preserve the creases and keep the garment hanging smooth and flat

The construction of the appliance is

#### The machinist says:

"Sure I'm using them, the same as most of the men in the shop are doing. Some of the Starrett Tools in my kit, I bought when I was an apprentice.

"Y'see, it's like this. We got the habit when we were kids. We saw the older men, the ones that were doing the finer work, preferred Starrett Tools because they knew they were accurate, and we copied after 'em—just like our kids are doing today.

"How's that? No, I wouldn't go so far as to say that Starrett Tools by themselves will make a good machinest, but I'll say this — Starrett Tools will make it a lot quier for any machinest to do good work.

"Yes, I've got one of their 'Starrett Data Books for Machinests,' and beheve me, it saves a lot of time and mutakes. If I want to know a decimal equivalent, a taper dimention, the speed of a milling cutter, or something about materials, I don't have to guess or ask — I just look in the book and find out. It set me back seventy-five tents at the hardware store, but it saved me a blame night more than that in the first week."

# The L. S. STARRETT COMPANY THE WORLD'S GREATEST TOOLHARERS Hamplecturers of Black Saws Unescelled

ATHOL, MASS.

in no planu, pipe nt, an flut, in the base ites, that a

The white and entersioner of Pinerell For high incombine in the constant Conding No. 21 W. work frequency request.

Mastrated Books Describing tions, FREE

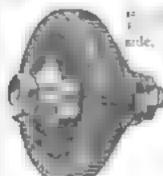
American Steel & Wire Co. P. Bindley, V.F. & B. B. A.





Tryslers South





but on in the ottsele of a window and listen to all that is sure inside. Attach it to your Phonograph and transmit music, etc., to distant points. The best Transmitter for Local and Long Distance Telephone Suver 75% Batteries. Super-sensitive. Send me \$1.00 for one Button with free descriptive booklet and circuit diagrams.

All kind of experimenters' supplies to stock. Receivers orduction coils, condensers, etc. Price list on request, Satistoction guaranteed or money back.

#### J. SKINDERVIKEN

Inventor and Sole Distributor

335 Broadway, New York City, or 154 West Standalph Street, Chicago, III.







#### Electricians' Knife Scissors and Tweezers

We can meet dealers' demands at once and offer attractive quantity prices

Write for description

MATHIAS KLEIN & SONS, Mirs.

CANAL STA. 3, CHICAGO

#### STAR STORAGE BATTERIES

More Dependable Lower
The 85ST Quarantee Lower In Price Likeral discounts to dealers: write for particulars

THE STAR STORAGE BATTERY COMPANY

Automobile Stucting and Lighting Butterine MUNCIE IND.

Small Steam Engines and Boilers Gar und Canalina Engines, H. P. ou. Tanks. Parage Gama Madril Makera. Supplier the drag ways in more power of the to improve a complete pos-MODERAL SOLS!

Don't Wear a Truss

Bronks' Appliance, the desired the second supported



Brooks' Rupture Appliance

Plan entermaths Air Corbbors Directs and Grand the bridge to to begin of the 4 to 10 to 50 to 10 to 10

BRIDGES APPLIANCE CO., 2500 State St., Marshall, Mich.

At a Cost of 1 .c Per Cord f Band Taday for Blg Special Offer and Law Invest Price on the OTTAWA Too See B a Faw Son Con made by Add of See made and the Used by U.S. Govi Cash or Easy Payments Schools . 30 Bays Trial 🕾 🗼 🗼 TOT AN EULIPANTEE LAP the op one. Officer life, the Buck Street, Where Lane,

so simple that anyone can make it at home by following the accompanying

tilustrations.

First procure a hoard 11 in wide and 31 in. long, and after taking the corners of one end off as shown in Fig. 1, insert a large acrew-eye in the end of the board

Then square a line across the same end of the hoard just 4 in. from the end. Thus in the line on which you will hinge the frame.

Make a mitered frame of wood 114 in. or 2 in. wide, just 18 in, by 20 in, inade measure. Before putting the frame together take the two long side pieces and placing them together with the inside edges

up, divide the length into eight parts and with your square mark across both edges. They should measure just 214 in. between marks.

Fig 2

**Position** 

of hang-

or after trousers.

are in

PIACE

The pert step is to bore seven b-in, holes, about half an inch deep in each piece, centered on these marks, and after cutting seven 't-in. dowel atteks to 14-in, lengths put the frame together, inserting the dowel sticks in the holes you have

The corners of this frame are made rigid with four small metal right angle corner braces placed on the under side of the frame.

Procure two strong hinges and hinge the frame to the back board on the line you have made 4 in, from the end of the back board as shown in Fig. 1.

Arrange a brace to hold the frame at right angles with the hanging board as shown in Fig. 1. This brace is hinged to the edge of the back board with a screw and has a deep notch cut in the other end to receive the last of the cross sticks in the frame.

The method of using the appliance is to brace up the frame in a horizontal position, place the bottom ends of the trouser legs over one of thecross sticks, and pull down until the garment is just half over the stick; and so on until all of the cross sticks are filled, when the frame is dropped flat against the back board. In this position it will take but very little room in the closet.

In removing the trousers it is only necessary to lift the frame with one hand and pull the garment down off the cross stick.

If it is thought desirable an additional acrew-eye may be placed in the lower end of the back board and a nail or acrew inserted through the screw-eye will hold the contrivance firm against the wall - MORTIMER V. TESSIER

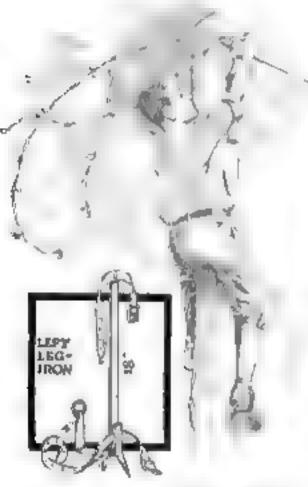
#### How to Make a Pair of Climbing Spurs

THE regulation lineman's climbers or spurs are somewhat expensive, but any boy may easily make a pair just as strong and equally as serviceable for about one third the cost.

Procure two pieces of common tire tron 27 in. long and 1½ in. wide—such as in used for buggy tires. Measure off 8 in. from one end and bend over at right angles, to make the foot-rest 4 in. wide, and the upturned part also 4 in. wide.

Now turn over one inch of the short upturned end and before closing, insert a 1-inch harness ring in the iron strap thus formed

For the spura, use two pieces of steel tire, about 5 in. long. Bend



Here is a pair of climbing spure that will enable you to cut tree limbs, etc.

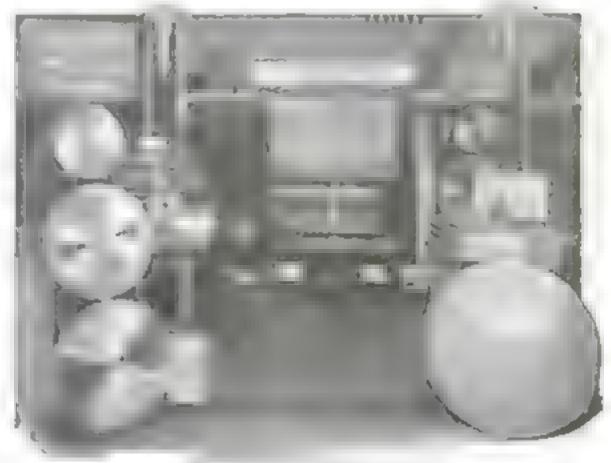
at an angle of about 45 degrees and draw out to make a point. Drill two holes along the shanks of the spurs, and soudly attach by riveting. In doing this, use riveta of about 3 16 in. size and 1 in long. Place a burr or washer between apur and leg from before riveting together; this makes a slot for the foot atrap.

The knee strap should be about 1½ in wide, and is attached to the top of the leg-iron by either turning over the end, or by riveting. He sure and place them on the same side as the spure, however

The foot-straps are attached by running the strap through the slot made by the burns between the rivets, once around the ankle, thence through the ring and then buckled.

Any blacksmith can supply the material for this home-made chimber and will drill the holes and supply the rivets, or make the whole thing for fifty or sixty cents.—Stillman Taylon.

# SIMONOS SAW STEEL PRODUCTS



Signanda Display-American Steel Treaters Exhibition, Chicago

#### Metal Put On Its Mettle

SIMONDS were willing to go on record before experts, when they exhibited their products to representative steel men of the country as shown in above photograph.

Wherever exhibited, wherever used, the quality of Simonds Special Alloy Steel wins for Simonds Saw Steel Products the enthusiastic approval of men who know steel and men who work with it.

Write for prices on any kind or size of metal or wood cutting saws,

# Simonds Manufacturing Co.

"THE SAW MAKERS" ESTABLISHED 1033

Fitchburg, Mass.

Chicago, Ill. New York City Portland, Ore. Lockport, N. Y. New Orleans, La. San Francisco, Cal. Vancouver, B. C. London, Eng Montreal, Que. Memphia, Tenn. Scattle, Wash St. John, N. B.

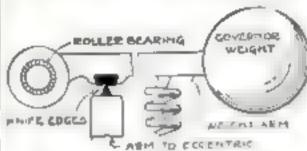




#### Put Roller Bearings in the Governor Weight Arm

K NIFE edges are associated in our mind with scales, and roller bearings with fast running machinery of the lighter variety. But such antifriction construction is proving a great and in heavy machinery, as for instance in steam engine governor parts whose regulating ability must be of the most sensitive kind, though the parts themselves may weigh a ton or two and the engine develop hundreds or thousands of horsepower

The illustration shows a weight arm mounted upon roller bearings. The



Adopt roller bearings to the weight arm of the governor and avoid friction and frequent repairs

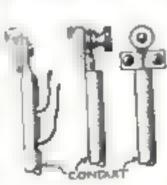
pin about which this turns may be around 3 in. in diameter and the total movement at the pin may be only by in; but the arm moves more easily and readily than a plain pin in a plain hole, a construction that starts from a set

position with a jerk.

The construction of the arm to the rod running to the eccentric is made by knife edge and seat. These are glass-hard pieces of tool steel. They also move readily from a dead position and with the slightest friction. An added advantage of the construction is cheapment of first cost, with long his and economical renewal. In the case of the knife edge held to its seat there is none of the looseness and pounding found with a pin-in-bearing construction the minute the fit wears beyond the bounds of a good running fit.—Donald A. Hampson.

#### Running Wires through an Automobile Condust

IT is impossible to be too careful about how ignition and other wires



To prevent those annoying short circuits run the ignution wires through conduits and eliminate the trouble

are tun on an automobile. and if wiring is carefully done you will be much emier in your mind on theroad. Wires entrying lowtension current are not heavily insulated. Ordinarily it is not necessary that they should be, so far an earrying

the current is concerned. But it is the unexpected that happens,

and protection of the wiring from outside injury cannot be too strongly urged.

It is a very good scheme to run such wires in a heavy woven tubular conduit, and not only does this protect, but it can also be used to support the wires and take the strain off the terminate

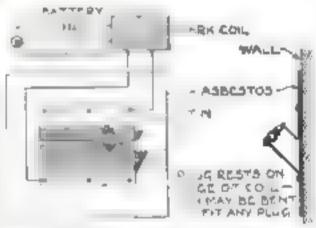
The illustration shows, in a suggestive way, how this can be done. Individual conditions will indicate the exact methods.—Howard Greene.

#### How to Make a Simple Spark-Plug Tester

If there is an old spark coil about, it may be transformed into an effective spark-plug tester, which is a very good thing to have about the garage or house.

The old coil is attached to the wall, and directly beneath it a sheet of asbestos is fastened with tacks. Two pieces of tin are procured, 6 inches long and 4 inches wide. One is bent into the shape of a fish-hook as shown at the right of the diagram. The other is bent into an obtuse angle.

These pieces of the are screwed on to the ashestos sheet with acrews smaller than the holes in the tin, and with insulating washers made from sheet



There are always two or three old spark plugs about the our. Test there at home then you won't get caught napping on the road.

rubber between the tin and the screws. This is to keep the insulation perfect. The pieces of tin are arranged so that when they are in place and a spark-plug is laid upon their edges, they will come in contact with the plug at the top and the bottom below the porcelain insulation.

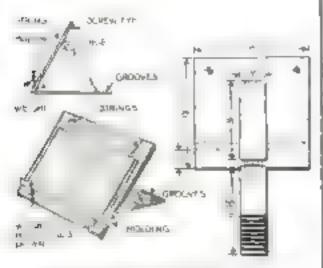
Three or four dry batteries should work the coil perfectly. Fasten them in some convenient place, and connect one wire from the battery to one of the binding posts of the primary, and the other to one connection of a push button as shown at the top of the diagram. Another wire is run from the other post of the switch to the other post of the primary, and the apparatus is complete.

A plug is tested by laying it on the edges of the tin and pressing the button. If the plug is functioning properly a spark will jump between

the gaps.-DALE VAN HORN.

#### A Handy Book-Stand for the Sick-Room

STRONG and handy adjustable A book stand may be made from four pieces of board picked up around the work-shop. The dimensions given in the diagram are for a book of



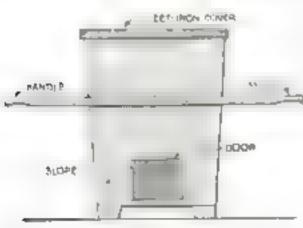
Adapted to the invalid as well as the lazy person, this stand holds the book in a readable position

ordinary size, but may easily be in pressed for larger books.

The drawing shown plainly how the stand may be tilted back to an angle to suit the reader. The pages are held down by atrings fastened to acrew-eyes on the back of the stand. in such a way that when the strings are laid across the book they will fall on the margin and not on the type. Weights are fastened on the strings to keep the pages flat. The book is held up by a molding nailed on the board. -M. Tocasen.

#### Use Sand to Extinguish a Gasoline or Oil Fire

SAND may be stored in a wooden receptacle similar to that shown in the illustration, and is best applied to

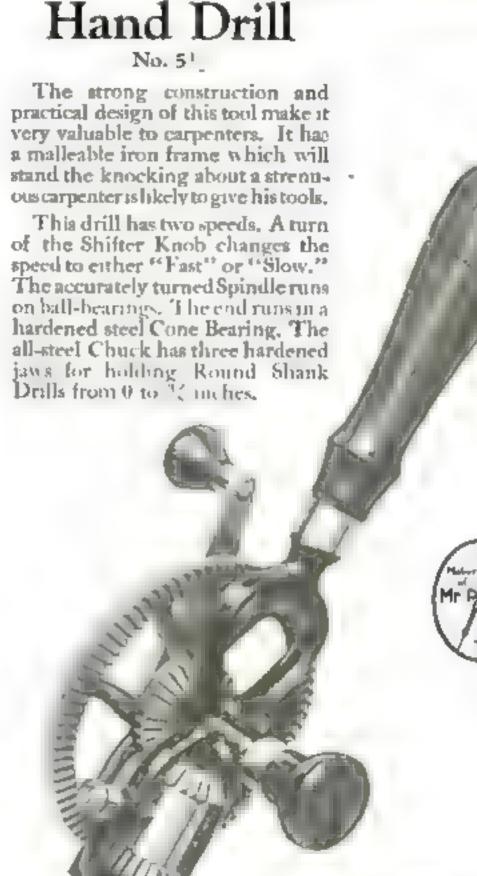


Throw sand on that fire and save buying expensive extenguishing apparatus. A sweeping movement dues the trick

the fire by means of a long-handled

The sand should be fairly dry and mixed with sodium bicarbonate, ten parts sand to one part sodium bicarbonate for the best results. This latter substance gives off a non-inflammable gas which forms an airtight blanket that excludes the flamefeeding oxygen. Roy H Posto's

# COOPELL PRAIM



This eleverly designed drill is typical of the Goodell-Pratt line of 1500 different tools. Every tool in this large line gives complete satisfaction to its owner.

Your dealer will be glad to have you examine this hand drill or a more complete description of it or of any other of the 1500 different Goodell-Pratt Tools will be sent on request.



#### The Lineman's Line of Tools

Phers made to fit his hand and to fit his work. Solid drop forged steel that stands up steadily in the hardest kind of use.

The Lineman insists on the best. You can trust his judgment

"Red Devil" Phers can be depended upon under all conditions. Of the more than 100 designs, you can select the one or two best suited for your needs.

Thoroughly insulated piters for high-tension wire work. Phenfor general use. Phens combining many different tools in one

> Our booklet will interest anyone interested in hand hols.

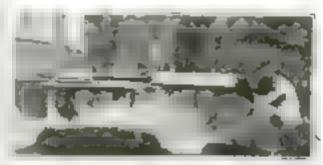
Pliera Electrician's Tools Hack Saw Frances Hack Saw Blades Augur Bits Cham Drills Glass Cutters Etc., etc., etc.

"Red Dutt" 6 point contact weaters; the most efficient speaken made.

Smith & Hemenway Co., Inc. 264 Broadway, New York Factories: Irvington, New Josep

#### A Ten-Foot Camera to Make Portraits of Insects

WHO would think that a 10 ft. camera could take pictures perlect in every detail? That such is the case is proved by the accompanying illustrations. The camera consists of two 5 ft. parts fitted with lightight joints. An excellent double anastigmat lens with a 2 in, aperture,



The camera is easily made as the illustration proves and the results secured are both instructive and interesting

suitable for a 4 by 5 camers is used, the lens being attached to one end of the camera and a ground glass to the other

If a small insect such as a butterfly is placed about a foot from the lens, its image is thrown upon the ground glass twenty times enlarged. The focusing must be done very carefully, and for this reason the ground glass is taken out after the adjustments are made. The time of exposure is bright sunlight is from 1 to 114 minutes



Here is one of the pertures taken by the ten foot ramers is shows the head of a butte 3/ greatly magnified.

Wi his a st alter less the time of exposure must be longer

The diversity of form and the peculiar appearance of our smaller insect life is wonderful beyond description and the pains taken to produce their potographs is well worth while as well as instance.—ERNEST BADE.

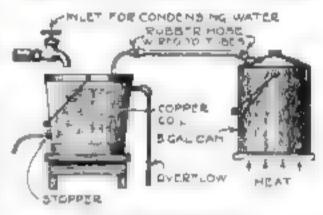
#### Distill Your Own Storage Battery Water

To keep storage batteries in a healthy condition for maximum service pure water must be added at stated intervals, usually about once a week. By pure water is meant

water reasonably free from mineral impurities which in time would accumulate in the bottom of the cells and impair the action of the battery. The three sources of pure water are rain water, melted artificial ice water and distilled water. The two former are in many cases hard to procure when most needed, but distilled water can be had at any time by means of a simple distilling arrangement herein described.

Distribug is accomplished by driving steam from a body of heated water through a tube sufficiently chilled to condense the steam back into fluid form. The solids are left behind and bure water is the result.

A five gallon kerosene can makes an admirable boiler. Punch a very small hole through the filler cap to allow for evaporation. Some steam will escape but will not interfere with the opera-



Distilled water is absolutely necessary to storage batteries. Here's a way to menufacture it cheaply

tion. Bend a spiral coll out of about ten feet of ly-in, copper tubing so it will fit easily into a common wooden water bucket.

Bore a large hole in the side of the bucket near the bottom and fit a wooden stopper to it. The lower end of the coil passes through a snug fitting hole in this stopper and turns downward to discharge its contents. By painting the part of the tubing enclosed by the stopper and the outside of the stopper itself with roofing paint and then forcing both in place a tight joint may be made.

Connect the upper and of the coil and the spout on the boiler with a piece of steam hose or heavy rubber tubing. Wire on each end to make

steam tight.

Provide running cold water for the bucket and pierce the side above the top coil for an overflow. By regulating the flow of water in the bucket the level can be kept above the coils without overflowing. But be sure to keep enough running in so the contents will not become warm.

Fill the boiler three quarters full and boil it just hard enough to throw off sufficient steam without creating pressure. This will fill the coils with steam which will quickly condense as it passes down the cold coils and will emerge as pure water in the jar below the discharge.

Keep the jar well corked when full to prevent contamination from the air—L. B. ROBBINS. ANNOUNCEMENT



#### RECORDS

AND littally Branswick Records—artistic companions of Branswick Phonographs. These records are made under the direction of great interpreters—men who have the power and faculty of developing musical selections as they would be played by the composers.

Just as there are directors for the opera, the stage, the orchestra, we now have directors for records.

This means that each Brunswick Record is not only the work of some accomplished artist, but is accompanied by the shadings of a renowned director.

This is why Brunswick Records rise above the qualities most records laive in common. Brunswicks are more than title and artist. They bear the impress of some guiding hand. One who knows how to bring out the inherent qualities, the halden beauty, the numeric personality, the more spiritual intuitions of the composers.

Ask to hear these records. Made by the House of Brunswick—a name renowned in the world of music. Compare Brunswick Records with others. Be their sale judge! Look for something entirely different. Something sweeter, richer, truck! You'll had it in full measure in this new Brunswick case!

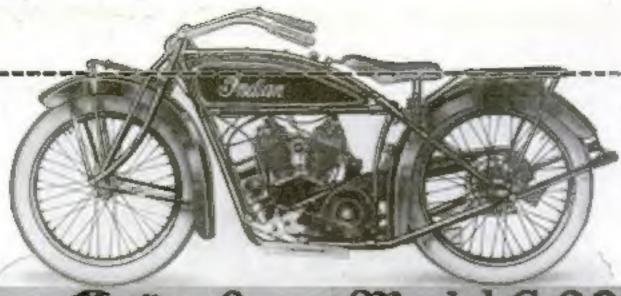


THE BRUNSWICK - BALKE - COLLENDER COMPANY

General Official 623-633 So. Walson Avenue, CHICAGO

Branch Houses in Principal Cities of Lating States, Memor and Camada

Marical Merchanting Sales Co., Rip Young St., Totoblo



The temperature of the INDIAN Seat of a section of the INDIAN Seat of a section of general and the estention of section of section of section of section of any other morning.

# Fndian Scout Model G-20



Bimplest yet mut Capandable motor form. Bug harmitener type, with a delta state water 15, main bors and 3 a took closed ment of 20.28 rates tooks. Roller bearings in motor abafts and anonecting rods. Most economical and something delta state in the strength of the state of the

POR years the motorcycling public has demanded a "perfect middleweight solo mount." This demand has now been met in the latest triumph of the "Factory behind the INDIAN"—the new INDIAN Scout Model G-20. Though this model is 100 pounds lighter than the far-famed Powerplus, nothing has been sacrificed in the way of strength or sturdiness or mechanical perfection.

INDIAN Scout innovations in design and construction are many. Note carefully the illustrations and descriptions of its motor and transmission, given on the left and right of this page. Eminent engineers and motorcycle experts have pronounced the INDIAN Scout the "marvel of motorcycle engineering." Its balance and ease of operation are remarkable. It is the most economically operated machine. 75 miles on a gallon of gasoline! And it's the cleanest and most silent of all motorcycles. Gives the greatest comfort in riding, and yields all the speed and power you'll ever want.

Call on your INDIAN dealer and look over his complete stock of 1920 INDIAN Models. Get a practical demonstration of the model that best suits your personal requirements. Don't delay—the demand from all sections of the country is tremendous. Write for FREE Catalog.

HENDEE MANUFACTURING CO.

Springfield, Mass.

The Largest Motorcycle Manufecturer in the World

In acti with color and clots. After sivel general and chaffs of more than ample strength by all requirements. The special operating regressively and on the color action of the color action of the color action in land to both positive action. Independently accessed,





# FOLDING CORONA— AS SIMPLE AS CLOSING A BOOK

Enril the adverse of Corona, manufacturers arraggled in tain to produce a writing machine combining the efficiency of the standard office typewrites with the compactness occurrent to purchasing.

It seemed recensary either to sacrifier features essential to the convenience of the operator or to adopt mechanical designs which would reduce the speed of operation or lower the character of the work.

The difficult problem is solved in Corona by using a folding carriage. This expedient makes possible a machine which, while very compact when folded, is of proper balance and proportions when ready for use. It also premies the use of a type has of standard length.

#### THE SECRET OF THE FOLDING TYPEW SITES

Gorona's folding formers makes possible the construction of a machine large enough for all peartical purposes, yet small enough in he portable.



# CORONA The Personal Writing Machine

fold it up-take it with you-typewrite anywhere



PAINTED FOR LOCKETT & NTERR TORACTO (M).

To be fashionable a cigarette need not be expensive. In fact, at most exclusive enough Turkish" blend lack the oily clubs and smart hotels the preference is for a relatively inexpensive cigarette-Fatima.

Of course, it is only logical that Fatima should appeal to the discriminating

smoker, for, not only does Fatima's "just heaviness of the expensive straight Turkish cigarette, but it retains, at the same time, a smoothness and richness not to be found in blends less fortunately balanced.

# Liggettenlyses Tobacco C

A Sensible Cigarette